

ACRP

REPORT 100

Recycling Best Practices— A Guidebook for Advancing Recycling from Aircraft Cabins

TL681
.C3
R43
2014

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

Sponsored by
the Federal
Aviation
Administration

ACRP OVERSIGHT COMMITTEE*

CHAIR

James Wilding
Metropolitan Washington Airports Authority
(retired)

VICE CHAIR

Kitty Freidheim
Freidheim Consulting

MEMBERS

James Crites
Dallas–Fort Worth International Airport
Richard de Neufville
Massachusetts Institute of Technology
Kevin C. Dolliole
Unison Consulting
John K. Duval
Austin Commercial, LP
Steve Grossman
Jacksonville Aviation Authority
Jeff Hamiel
Minneapolis–St. Paul
Metropolitan Airports Commission
Kelly Johnson
Northwest Arkansas Regional Airport Authority
Catherine M. Lang
Federal Aviation Administration
Gina Marie Lindsey
Los Angeles World Airports
Carolyn Motz
Airport Design Consultants, Inc.
Richard Tucker
Huntsville International Airport

EX OFFICIO MEMBERS

Paula P. Hochstetler
Airport Consultants Council
Sabrina Johnson
U.S. Environmental Protection Agency
Richard Marchi
Airports Council International—North America
Laura McKee
Airlines for America
Henry Ogrodzinski
National Association of State Aviation Officials
Melissa Sabatine
American Association of Airport Executives
Robert E. Skinner, Jr.
Transportation Research Board

SECRETARY

Christopher W. Jenks
Transportation Research Board

TRANSPORTATION RESEARCH BOARD 2013 EXECUTIVE COMMITTEE*

OFFICERS

CHAIR: **Deborah H. Butler**, Executive Vice President, Planning, and CIO, Norfolk Southern Corporation, Norfolk, VA
VICE CHAIR: **Kirk T. Steudle**, Director, Michigan DOT, Lansing
EXECUTIVE DIRECTOR: **Robert E. Skinner, Jr.**, Transportation Research Board

MEMBERS

Victoria A. Arroyo, Executive Director, Georgetown Climate Center, and Visiting Professor, Georgetown University Law Center, Washington, DC
Scott E. Bennett, Director, Arkansas State Highway and Transportation Department, Little Rock
William A. V. Clark, Professor of Geography (emeritus) and Professor of Statistics (emeritus), Department of Geography, University of California, Los Angeles
James M. Crites, Executive Vice President of Operations, Dallas–Fort Worth International Airport, TX
Malcolm Dougherty, Director, California Department of Transportation, Sacramento
John S. Halikowski, Director, Arizona DOT, Phoenix
Michael W. Hancock, Secretary, Kentucky Transportation Cabinet, Frankfort
Susan Hanson, Distinguished University Professor Emerita, School of Geography, Clark University, Worcester, MA
Steve Heminger, Executive Director, Metropolitan Transportation Commission, Oakland, CA
Chris T. Hendrickson, Duquesne Light Professor of Engineering, Carnegie Mellon University, Pittsburgh, PA
Jeffrey D. Holt, Managing Director, Bank of Montreal Capital Markets, and Chairman, Utah Transportation Commission, Huntsville, UT
Gary P. LaGrange, President and CEO, Port of New Orleans, LA
Michael P. Lewis, Director, Rhode Island DOT, Providence
Joan McDonald, Commissioner, New York State DOT, Albany
Donald A. Osterberg, Senior Vice President, Safety and Security, Schneider National, Inc., Green Bay, WI
Steve Palmer, Vice President of Transportation, Lowe's Companies, Inc., Mooresville, NC
Sandra Rosenbloom, Professor, University of Texas, Austin
Henry G. (Gerry) Schwartz, Jr., Chairman (retired), Jacobs/Sverdrup Civil, Inc., St. Louis, MO
Kumares C. Sinha, Olson Distinguished Professor of Civil Engineering, Purdue University, West Lafayette, IN
Daniel Sperling, Professor of Civil Engineering and Environmental Science and Policy; Director, Institute of Transportation Studies; University of California, Davis
Gary C. Thomas, President and Executive Director, Dallas Area Rapid Transit, Dallas, TX
Paul Trombino III, Director, Iowa DOT, Ames
Phillip A. Washington, General Manager, Regional Transportation District, Denver, CO

EX OFFICIO MEMBERS

Rebecca M. Brewster, President and COO, American Transportation Research Institute, Marietta, GA
Anne S. Ferro, Administrator, Federal Motor Carrier Safety Administration, U.S. DOT
John T. Gray II, Senior Vice President, Policy and Economics, Association of American Railroads, Washington, DC
Michael P. Huerta, Administrator, Federal Aviation Administration, U.S. DOT
Paul N. Jaenichen, Sr., Acting Administrator, Maritime Administration, U.S. DOT
Michael P. Melaniphy, President and CEO, American Public Transportation Association, Washington, DC
Victor M. Mendez, Administrator, Federal Highway Administration, U.S. DOT
Robert J. Papp (Adm., U.S. Coast Guard), Commandant, U.S. Coast Guard, U.S. Department of Homeland Security
Lucy Phillips Priddy, Research Civil Engineer, U.S. Army Corps of Engineers, Vicksburg, MS, and Chair, TRB Young Members Council, Washington, DC
Cynthia L. Quarterman, Administrator, Pipeline and Hazardous Materials Safety Administration, U.S. DOT
Peter M. Rogoff, Administrator, Federal Transit Administration, U.S. DOT
Craig A. Rutland, U.S. Air Force Pavement Engineer, Air Force Civil Engineer Center, Tyndall Air Force Base, FL
David L. Strickland, Administrator, National Highway Traffic Safety Administration, U.S. DOT
Joseph C. Szabo, Administrator, Federal Railroad Administration, U.S. DOT
Polly Trottenberg, Under Secretary for Policy, U.S. DOT
Robert L. Van Antwerp (Lt. General, U.S. Army), Chief of Engineers and Commanding General, U.S. Army Corps of Engineers, Washington, DC
Barry R. Wallerstein, Executive Officer, South Coast Air Quality Management District, Diamond Bar, CA
Gregory D. Winfree, Administrator, Research and Innovative Technology Administration, U.S. DOT
Frederick G. (Bud) Wright, Executive Director, American Association of State Highway and Transportation Officials, Washington, DC

*Membership as of November 2013.

*Membership as of November 2013.

ACRP REPORT 100

**Recycling Best Practices—
A Guidebook for Advancing
Recycling from Aircraft Cabins**

CASCADIA CONSULTING GROUP
Seattle, WA

WITH

LEIGHFISHER MANAGEMENT CONSULTANTS
Burlingame, CA

AND

MARY LOQUVAM CONSULTING
Bellingham, WA

Subscriber Categories

Aviation • Administration and Management • Education and Training
Environment • Maintenance and Preservation

Research sponsored by the Federal Aviation Administration

TRANSPORTATION RESEARCH BOARD

WASHINGTON, D.C.
2014
www.TRB.org

AIRPORT COOPERATIVE RESEARCH PROGRAM

Airports are vital national resources. They serve a key role in transportation of people and goods and in regional, national, and international commerce. They are where the nation's aviation system connects with other modes of transportation and where federal responsibility for managing and regulating air traffic operations intersects with the role of state and local governments that own and operate most airports. Research is necessary to solve common operating problems, to adapt appropriate new technologies from other industries, and to introduce innovations into the airport industry. The Airport Cooperative Research Program (ACRP) serves as one of the principal means by which the airport industry can develop innovative near-term solutions to meet demands placed on it.

The need for ACRP was identified in *TRB Special Report 272: Airport Research Needs: Cooperative Solutions* in 2003, based on a study sponsored by the Federal Aviation Administration (FAA). The ACRP carries out applied research on problems that are shared by airport operating agencies and are not being adequately addressed by existing federal research programs. It is modeled after the successful National Cooperative Highway Research Program and Transit Cooperative Research Program. The ACRP undertakes research and other technical activities in a variety of airport subject areas, including design, construction, maintenance, operations, safety, security, policy, planning, human resources, and administration. The ACRP provides a forum where airport operators can cooperatively address common operational problems.

The ACRP was authorized in December 2003 as part of the Vision 100-Century of Aviation Reauthorization Act. The primary participants in the ACRP are (1) an independent governing board, the ACRP Oversight Committee (AOC), appointed by the Secretary of the U.S. Department of Transportation with representation from airport operating agencies, other stakeholders, and relevant industry organizations such as the Airports Council International-North America (ACI-NA), the American Association of Airport Executives (AAAE), the National Association of State Aviation Officials (NASAO), Airlines for America (A4A), and the Airport Consultants Council (ACC) as vital links to the airport community; (2) the TRB as program manager and secretariat for the governing board; and (3) the FAA as program sponsor. In October 2005, the FAA executed a contract with the National Academies formally initiating the program.

The ACRP benefits from the cooperation and participation of airport professionals, air carriers, shippers, state and local government officials, equipment and service suppliers, other airport users, and research organizations. Each of these participants has different interests and responsibilities, and each is an integral part of this cooperative research effort.

Research problem statements for the ACRP are solicited periodically but may be submitted to the TRB by anyone at any time. It is the responsibility of the AOC to formulate the research program by identifying the highest priority projects and defining funding levels and expected products.

Once selected, each ACRP project is assigned to an expert panel, appointed by the TRB. Panels include experienced practitioners and research specialists; heavy emphasis is placed on including airport professionals, the intended users of the research products. The panels prepare project statements (requests for proposals), select contractors, and provide technical guidance and counsel throughout the life of the project. The process for developing research problem statements and selecting research agencies has been used by TRB in managing cooperative research programs since 1962. As in other TRB activities, ACRP project panels serve voluntarily without compensation.

Primary emphasis is placed on disseminating ACRP results to the intended end-users of the research: airport operating agencies, service providers, and suppliers. The ACRP produces a series of research reports for use by airport operators, local agencies, the FAA, and other interested parties, and industry associations may arrange for workshops, training aids, field visits, and other activities to ensure that results are implemented by airport-industry practitioners.

ACRP REPORT 100

Project 02-15

ISSN 1935-9802

ISBN 978-0-309-28367-0

Library of Congress Control Number 2013953980

© 2014 National Academy of Sciences. All rights reserved.

COPYRIGHT INFORMATION

Authors herein are responsible for the authenticity of their materials and for obtaining written permissions from publishers or persons who own the copyright to any previously published or copyrighted material used herein.

Cooperative Research Programs (CRP) grants permission to reproduce material in this publication for classroom and not-for-profit purposes. Permission is given with the understanding that none of the material will be used to imply TRB or FAA endorsement of a particular product, method, or practice. It is expected that those reproducing the material in this document for educational and not-for-profit uses will give appropriate acknowledgment of the source of any reprinted or reproduced material. For other uses of the material, request permission from CRP.

NOTICE

The project that is the subject of this report was a part of the Airport Cooperative Research Program, conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council.

The members of the technical panel selected to monitor this project and to review this report were chosen for their special competencies and with regard for appropriate balance. The report was reviewed by the technical panel and accepted for publication according to procedures established and overseen by the Transportation Research Board and approved by the Governing Board of the National Research Council.

The opinions and conclusions expressed or implied in this report are those of the researchers who performed the research and are not necessarily those of the Transportation Research Board, the National Research Council, or the program sponsors.

The Transportation Research Board of the National Academies, the National Research Council, and the sponsors of the Airport Cooperative Research Program do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of the report.

Published reports of the

AIRPORT COOPERATIVE RESEARCH PROGRAM

are available from:

Transportation Research Board
Business Office
500 Fifth Street, NW
Washington, DC 20001

and can be ordered through the Internet at

<http://www.national-academies.org/trb/bookstore>

Printed in the United States of America

THE NATIONAL ACADEMIES

Advisers to the Nation on Science, Engineering, and Medicine

The **National Academy of Sciences** is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. On the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Ralph J. Cicerone is president of the National Academy of Sciences.

The **National Academy of Engineering** was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. C. D. Mote, Jr., is president of the National Academy of Engineering.

The **Institute of Medicine** was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, on its own initiative, to identify issues of medical care, research, and education. Dr. Harvey V. Fineberg is president of the Institute of Medicine.

The **National Research Council** was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purposes of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both Academies and the Institute of Medicine. Dr. Ralph J. Cicerone and Dr. C. D. Mote, Jr., are chair and vice chair, respectively, of the National Research Council.

The **Transportation Research Board** is one of six major divisions of the National Research Council. The mission of the Transportation Research Board is to provide leadership in transportation innovation and progress through research and information exchange, conducted within a setting that is objective, interdisciplinary, and multimodal. The Board's varied activities annually engage about 7,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation. www.TRB.org

AUTHOR ACKNOWLEDGMENTS

Cascadia Consulting Group served as the principal investigator for ACRP Project 02-15, with support from LeighFisher Management Consultants and Mary Loquvam Consulting. The research team wishes to thank the many airlines, airports, and flight kitchens that participated in the research and contributed valuable information to support the development of this guidebook.

Airlines

Alaska Airlines
American Airlines
Delta Air Lines
Great Lakes Airlines
Southwest Airlines
United Airlines (and Continental, formerly)
US Airways
Virgin America

Flight Kitchens

Gate Gourmet
LSG Sky Chefs
Airline in-house provisioning operations

Airports

Abilene Regional Airport, TX (ABI)
Akron-Canton Airport, OH (CAK)
Albany International Airport, NY (ALB)
Albuquerque International Sunport, NM (ABQ)
Anchorage International Airport, AK (ANC)
Austin-Bergstrom International Airport, TX (AUS)
Bangor International Airport, ME (BGR)
Baton Rouge International Airport, LA (BTR)
Billings Logan International Airport, MT (BIL)
Blue Grass Airport—Lexington, KY (LEX)
Boston Logan International Airport, MA (BOS)
Bradley International Airport, CT (BDL)
Buffalo Niagara International Airport, NY (BUF)
Burbank Bob Hope Airport, CA (BUR)
Charleston Yeager Airport, WV (CRW)
Chicago O'Hare International Airport, IL (ORD)
Cleveland Hopkins International Airport, OH (CLE)
Corpus Christi International Airport, TX (CRP)
Dallas Love Field International Airport, TX (DAL)
Dallas/Fort Worth International Airport, TX (DFW)
Dane County Regional Airport, WI (MSN)
Daytona Beach International Airport, FL (DAB)
Denver International Airport, CO (DEN)
Fresno Yosemite International Airport, CA (FAT)
Gerald R. Ford International Airport—Grand Rapids, MI (GRR)

Greenville-Spartanburg Airport, SC (GSP)
Hartsfield-Jackson Atlanta International Airport, GA (ATL)
Jackson-Evers International Airport, MS (JAN)
John F. Kennedy International Airport, NY (JFK)
Kansas City International Airport, MO (MCI)
LaGuardia Airport, NY (LGA)
Lafayette Regional Airport, LA (LFT)
Lambert-St. Louis International Airport, MO (STL)
Long Beach Airport, CA (LGB)
Los Angeles International Airport, CA (LAX/LAWA)
Manchester Boston Regional Airport, NH (MHT)
Midland International Airport, TX (MAF)
Minneapolis/St. Paul International Airport, MN (MSP)
Nashville International Airport, TN (BNA)
Newark Liberty International Airport, NJ (EWR)
Northeast Florida Regional Airport—St. Augustine, FL (UST)
Orlando Sanford International Airport, FL (SFB)
Palm Beach International Airport, FL (PBI)
Palm Springs International Airport, CA (PSP)
Pensacola International Airport, FL (PNS)
Phoenix Sky Harbor International Airport, AZ (PHX)
Pittsburgh International Airport, PA (PIT)
Port Columbus International Airport, OH (CMH)
Portland International Airport, OR (PDX)
Portsmouth International Airport, NH (PSM)
Quad City International Airport—Moline, IL (MLI)
Reno-Tahoe International Airport, NV (RNO)
Ronald Reagan Washington National Airport, VA (DCA)
Salt Lake City International Airport, UT (SLC)
San Antonio International Airport, TX (SAT)
San Francisco International Airport, CA (SFO)
San Jose International Airport, CA (SJC)
Savannah/Hilton Head International Airport, GA (SAV)
Seattle-Tacoma International Airport, WA (SEA)
Southwest Florida International Airport—Fort Myers, FL (RSW)
Tallahassee Regional Airport, FL (TLH)
Tampa International Airport, FL (TPA)
Tulsa International Airport, OK (TUL)
Washington Dulles International Airport, VA (IAD)
Westchester County Airport, NY (HPN)



CONTENTS

1 Summary

3 The Business Case for Recycling

- 3 Disposal of Aircraft Cabin Waste Costs Millions
- 3 Recyclables Are Valuable
- 5 Recycling Is an Industry Trend
- 5 Getting Ahead of Regulations
- 6 Contributing to a Healthy Environment
- 6 Recycling Creates Jobs

8 A Partnership for Advancing Recycling

10 Recycling Guidebook Overview

- 10 Best Practices
- 11 Supporting Research

13 Best Practice #1. Secure Top-Down and Bottom-Up Commitment to Boost Recycling Participation and Results

- 13 Why Is This Practice Important?
- 13 Key Steps to Gaining Commitment
- 13 Step 1: Gain Support from Executive Leadership
- 14 Step 2: Recruit and Empower Champions
- 15 Step 3: Establish an Interdepartmental Green Team

17 Best Practice #2. Make Purchasing Choices that Facilitate Recycling and Reduce Waste

- 17 Why Is This Practice Important?
- 18 Key Steps to Green Purchasing
- 18 Step 1: Consider Recyclable, Compostable, or Waste-Reducing Service Item Options
- 19 Step 2: Test Environmentally Preferable Products and Develop Specifications for Procurement
- 19 Step 3: Share Best Practices with Others
- 19 Step 4: Support the Procurement Department in Incorporating Green Purchasing

21 Best Practice #3. Maximize Recycling by Separating Materials in Flight

- 21 Why Is This Practice Important?
- 22 Key Steps to Successful In-Flight Separation
- 22 Step 1: Design a Recycling Program with Input from Key Participants
- 23 Step 2: Implement Consistent Procedures for Collecting and Storing Materials in Flight

24	Step 3: Ensure that Flight Attendants Have Adequate Information, Training, and Support
25	Step 4: Equip Flight Kitchen, Cabin Service, and Terminal Maintenance Personnel to Contribute to an Effective Recycling Program
27	Step 5: Engage and Educate Passengers Early and Often
28	Best Practice #4. Track, Evaluate, and Share Data on Program Performance to Promote Transparency and Support Continuous Improvement
28	Why Is This Practice Important?
28	Key Steps to Tracking and Evaluating Program Performance
29	Step 1: Conduct a Baseline Waste Assessment
30	Step 2: Work with Waste and Recycling Service Providers to Obtain Monthly Program Reports
30	Step 3: Track and Share Data on Program Performance and Identify Opportunities for Improvement
31	Step 4: Align Price Signals with Program Performance so that Participants Can Benefit from Recycling Achievements
32	Step 5: Share Results with Colleagues to Foster Transparency, Leadership, and Partnerships across the Industry
34	Best Practice #5. Make Recycling Part of Everyday Business and Celebrate Success
34	Why Is This Practice Important?
34	Key Steps to Make Recycling Part of Everyday Business and Celebrate Achievements
35	Step 1: Incorporate Recycling into New and Ongoing Employee Training
36	Step 2: Embed Recycling Expectations into Service Standards and Contracts
36	Step 3: Recognize and Reward Employees and Other Participants Who Contribute to Recycling
37	Step 4: Share Results and Celebrate Achievements with Program Participants and the Public
38	Implementing Best Practices
39	Taking It to the Next Level
39	Foster Industry Learning through Further Research and Collaboration
40	Improve Program Performance through Innovative Best Practices
41	Endnotes
43	Appendix A Definition of Terms
45	Appendix B Recycling Best Practices Summary Sheets
55	Appendix C Best Practices Resources
70	Appendix D Supporting Research
77	Appendix E Additional Best Practices

Note: Many of the photographs, figures, and tables in this report have been converted from color to grayscale for printing. The electronic version of the report (posted on the Web at www.trb.org) retains the color versions.



Recycling Best Practices— A Guidebook for Advancing Recycling from Aircraft Cabins

Recycling is good for business, the economy, and the environment. Businesses that prevent and recycle waste can save money, generate revenue, and increase efficiency. In 2010, disposal of passenger aircraft waste cost the industry an estimated \$20 to \$26 million.¹ Valuable recyclables contained in that waste had a total market value estimated at \$18 to \$26 million.²

Mainstream media has recognized the environmental and sustainability accomplishments of such airlines and airports as Alaska Airlines, American Airlines, Continental Airlines (now United), Delta Air Lines, Southwest Airlines, and Denver, Los Angeles, Portland, San Francisco, and Seattle-Tacoma international airports, among others in the commercial aviation industry.

This guidebook, which is based on research conducted under ACRP Project 02-15, is intended to equip **airlines**, **airports**, and **flight kitchens**—broadly defined to include both contracted catering companies and airline-operated provisioning operations—to take advantage of this business opportunity and reduce waste. (Appendix A defines key terms used in this guidebook.)

ACRP Project 02-15 focused on **improving recycling and reducing passenger waste from aircraft cabins**, particularly materials related to in-flight food and beverage service on domestic flights. Information about improving airport-wide and passenger terminal recycling has been detailed in other publications and was therefore not a focus.³

Currently, deplaned waste and recyclables typically are directed to one of the following:

- An **airport-managed** system, in which cabin service crews or terminal maintenance personnel take materials to waste or recycling containers owned or operated by the *airport* or its contractor.
- An **airline-managed** system, in which **one** of the following occurs:
 - Flight kitchen crews take materials back to flight kitchens and in-house airline provisioning operations for handling, **or**
 - Cabin service crews place materials in containers owned or operated by the *airline* or its contractor.

Deplaned materials may either be disposed of or recycled through one of these systems, depending on the airport, airline, and flight kitchen location. At airports where recycling infrastructure is not available or easily accessible to airlines, airlines may back-haul or transport recyclables to another location with suitable recycling services.

Research identified **five key best practices** that are advancing aviation recycling across the country:

- **Best Practice #1.** Secure top-down and bottom-up commitment to boost recycling participation and results.
- **Best Practice #2.** Make purchasing choices that facilitate recycling and reduce waste.

- **Best Practice #3.** Maximize recycling by separating materials in flight.
- **Best Practice #4.** Track, evaluate, and share data on program performance to promote transparency and support continuous improvement.
- **Best Practice #5.** Make recycling part of everyday business and celebrate success.

These practices are intended to **fully utilize and expand on the existing airport- and airline-managed systems for handling deplaned materials** described above, recognizing the variability in recycling services across the country.

The best practices apply to airlines, large- and medium-hub airports, small- and non-hub airports, and flight kitchens. **Recycling best practices summary sheets**, included in Appendix B and available at www.trb.org/Main/Blurbs/169528.aspx, summarize key practices for each of these four audiences.

This guidebook uses the following icons to identify the key audiences involved in the various recycling best practices.



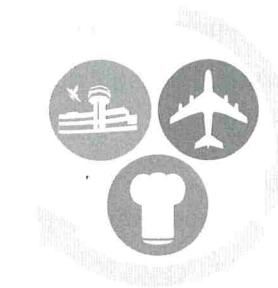
indicates that the key audience is airports, including large hubs, medium hubs, small hubs, and non-hub airports.



indicates that the key audience is airlines, focusing on major domestic carriers.



indicates that the key audience is flight kitchen and airline catering operations, including contractors as well as in-house airline provisioning activities.



indicates a cooperative effort by airports, airlines, and flight kitchens.

The guidebook is based on the following extensive research:

- Analysis of surveys completed by 66 airports and 8 airlines
- Field research at 11 U.S. airports of varying sizes, 6 major airlines and their regional partners, and flight kitchens at selected airports
- A literature review of more than 30 reports, journal articles, and other publications

Appendix C provides sample materials and other resources related to the best practices identified in this guidebook, and Appendix D summarizes key supporting research for this guidebook. Appendix E provides examples of innovative waste reduction and recycling best practices in addition to those presented in the main body of the guidebook.



The Business Case for Recycling

U.S. airlines, airports, and flight kitchens can benefit from advancing recycling in their organizations and throughout the commercial aviation industry. **Recycling reduces the cost of waste disposal and can generate revenue through the sale of valuable materials.** Markets for recyclable materials are growing stronger as prices for raw materials rise. Recycling of key commodities from homes and businesses has become commonplace in many parts of the United States. Meanwhile, a growing number of consumers place a priority on environmental performance and on supporting environmentally responsible companies.

Disposal of Aircraft Cabin Waste Costs Millions

In 2010, more than 200,000 tons of waste from passenger aircraft were collected at U.S. airports. According to industry estimates, the annual cost of disposing of this waste is \$20 to \$26 million.⁴

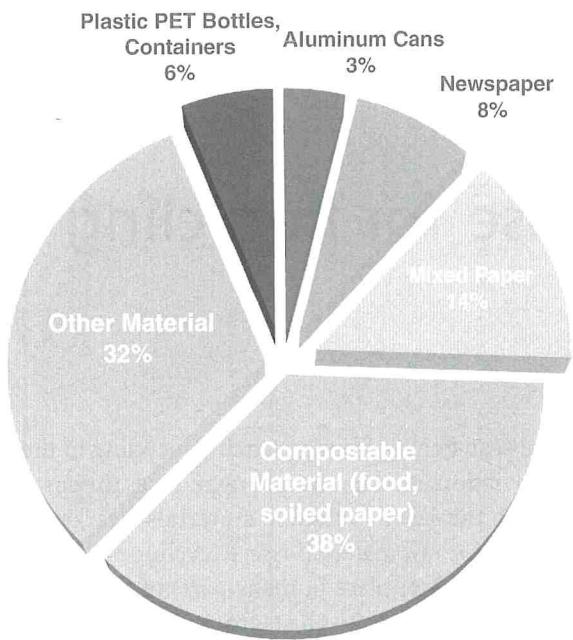
A recent update of the "Green Gauge" survey conducted by Roper/GfK on behalf of SC Johnson suggests that despite economic concerns, Americans still want companies to "go green," and they give credit to companies that do so.

Recyclables Are Valuable

Waste composition studies of aircraft cabin waste from multiple airlines conducted at Seattle-Tacoma International Airport (SEA) and Portland International Airport (PDX) suggest that **25 to 35 percent of waste material generated from passenger aircraft** (both disposed of and recycled, by weight) **consists of valuable and commonly recyclable materials.**⁵ Figure 1 shows the average composition of materials generated by aircraft landing at SEA and PDX.

Assuming that 25 to 35 percent of waste generated on board aircraft is recyclable, **the total market value of common recyclable materials generated from U.S. passenger aircraft flights is estimated at \$18 to \$26 million annually.**⁶ By collecting recyclable materials, airlines, airports, and flight kitchens can reduce their total waste disposal costs while demonstrating environmental stewardship.

Figure 2 provides the regional market prices for key recyclables across the United States, showing that prices for these materials are relatively consistent across the country.⁷



(Note: Numbers do not add to 100 percent due to rounding.)

Figure 1. Composition of waste material generated from passenger aircraft, December 2011.

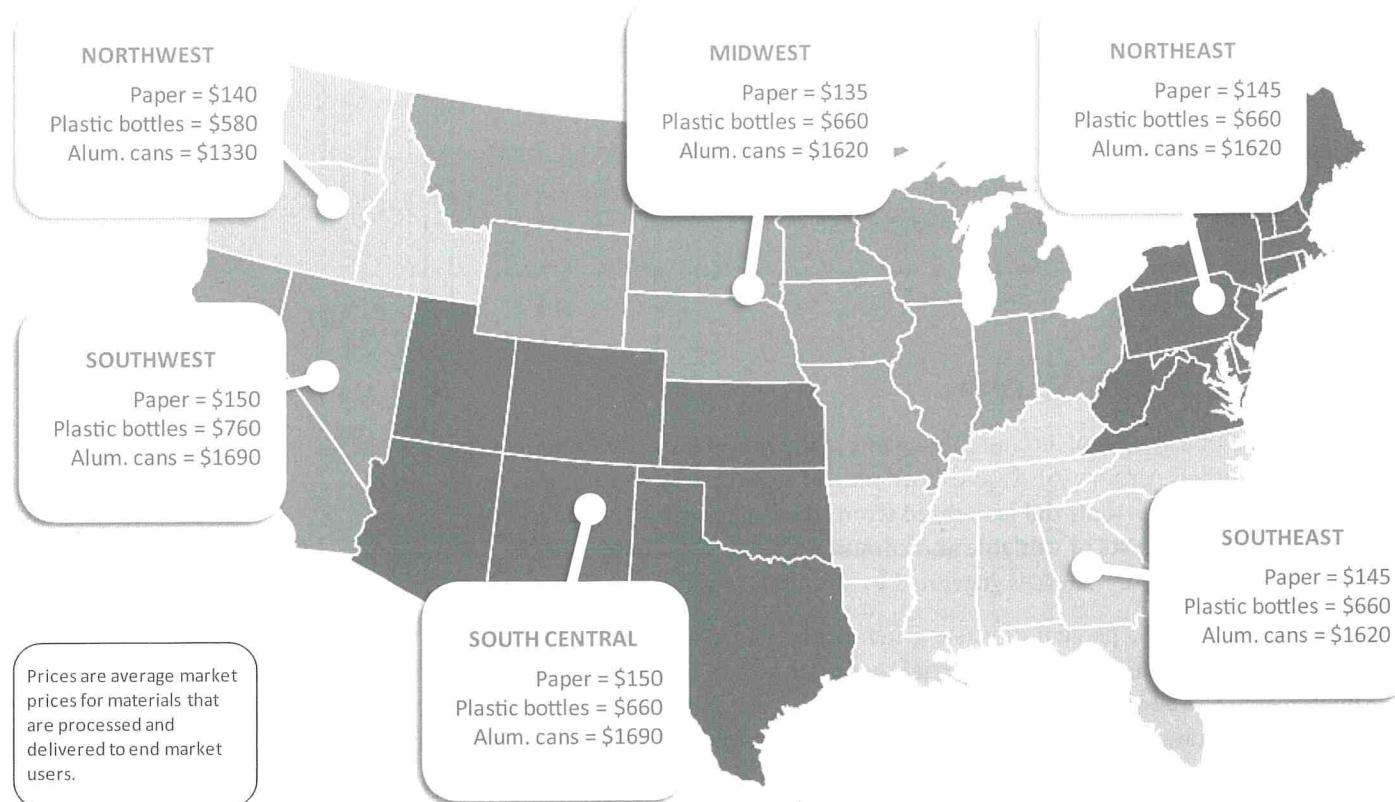


Figure 2. Average market prices for recycled materials by U.S. region (per ton, 2011).

Southwest Airlines' in-flight recycling program generated \$200,000 in recycling revenue in 2010. Recycling is standard practice for Southwest flight attendants. The airline's recycling system is designed around offloading recyclables only at airports with Southwest provisioning stations or other recycling services convenient for the airline. Otherwise, materials may be carried to the next destination for recycling.

Recycling Is an Industry Trend

The recycling efforts of the commercial aviation industry are growing and making headlines. In recent years, major news organizations including the *New York Times*, *USA Today*, and *Scientific American* have published articles examining airline and airport recycling efforts. As media and public interest in the environmental and sustainability practices of corporations grows, successful recycling programs can provide value for public relations and media coverage. Several airlines, such as **Alaska Airlines**, **American Airlines**, **Continental Airlines** (now **United**), **Delta Air Lines**, and **Southwest Airlines**, have received awards and recognition for their recycling and environmental programs, including efforts to improve recycling from aircraft cabins.⁸

In-Flight Recycling

In 2010, Delta Air Lines was ranked highest of 11 airlines evaluated on in-flight recycling efforts by Green America, a national nonprofit consumer organization.

In 2009, the EPA's WasteWise program recognized Delta's extensive in-flight recycling expansion efforts since 2007. In 2008, EPA awarded its WasteWise Gold Achievement Award to Delta in recognition of the airline's commitment to educating employees on the importance of recycling.

Delta Air Lines publishes recycling results through its website, in-flight magazine, and distribution network of flight attendants, flight kitchens, and airports.



Getting Ahead of Regulations

Mandatory commercial recycling regulations can influence the way airports manage and report on recycling programs. Several U.S. states and local governments have made recycling mandatory for businesses and other entities in their jurisdictions. The State of California recently passed legislation setting a 75 percent recycling goal and requiring commercial recycling statewide, which will affect all airports in the state.⁹

Local and state governments continue to adopt new recycling laws and rules, meaning that more and more businesses and commercial property owners will be required to provide recycling opportunities for tenants and customers in many parts of the country. Some examples of states and local governments that are adopting mandatory recycling regulations are the following:

State of California
State of Connecticut
State of New Jersey
State of North Carolina

State of Rhode Island
City of Chicago (IL)
City of Honolulu (HI)
City of Minneapolis (MN)

City of New York (NY)	Centre County (PA)
City of Philadelphia (PA)	Charlotte-Mecklenburg County (NC)
City of Pittsburgh (PA)	Collier County (FL)
City of Portland (OR)	Dutchess County (NY)
City of San Francisco (CA)	Miami-Dade County (FL)
City of Seattle (WA)	Sarasota County (FL)
Alachua County (FL)	Ulster County (NY)

For details and links to existing regulations, see the “Mandatory Recycling Commercial Recycling Regulation Examples” section in Appendix C.

Contributing to a Healthy Environment

Recycling saves energy, conserves natural resources, and reduces emissions of greenhouse gases and other pollutants. For example, the energy savings from recycling a ton of aluminum are equivalent to saving 36 barrels of oil, and recycling just one aluminum can saves enough electricity to light an energy-efficient bulb for 14 hours.¹⁰

Recycling materials decreases the amount of waste being deposited in landfills and also minimizes the air emissions and ash generation caused by incineration.

Recycling is one way that airlines, airports, and flight kitchens can demonstrate their commitment to environmental stewardship and green business practices.



Airlines Walking the Talk

In 2009, Southwest Airlines began testing a Green Plane, which it says is “a flying testament to our philosophy that environmental decisions make good business sense.” The aircraft features a host of environmentally responsible innovations, including the use of recycled-content and recyclable elements in the cabin interior. Recyclable elements include seat covers made with recycled content and Interface Flor carpet tiles that are recyclable once they reach the end of their useful life. The airline now plans to incorporate these green design elements throughout its fleet.

Recycling Creates Jobs

Research indicates that the recycling industry supports up to 35 times as many jobs per ton of materials recycled and remanufactured than disposing of those materials as waste as shown in Table 1. In addition, jobs in the recycling industry, on average, pay more than the average national wage. Research conducted by CalRecycle, part of California’s Environmental Protection Agency, found that recycling has approximately twice the overall economic benefit of landfill disposal.¹¹

Table 1. Jobs created in waste and recycling industries.¹²

Jobs Created per 10,000 tons of materials processed per year in the United States	
Recycling-based Manufacturing	25–100 depending on material and industry
Materials Recovery Facilities	10–20
Composting	4–5
Landfill and Incineration	1

A Zero-Waste Airport Terminal

San Francisco International Airport (SFO) designed its new Terminal 2 with zero waste in mind, embedding 16 sustainable policies in all concessionaire contracts, including a policy that all disposable materials must be compostable or recyclable.

Accordingly, the Terminal 2 food court has no garbage containers—only recycling and composting bins. SFO's water refilling station also helps eliminate the consumption and disposal of single-use water bottles.

Sam Mehta, SFO Environmental Services Manager, says designing for zero waste has worked extremely well, and he is now incorporating the 16-point sustainability plan into the airport's other existing terminals.





A Partnership for Advancing Recycling

The systems for managing waste and recyclable materials from aircraft cabins are complex and often involve multiple parties, including airlines, airports, and flight kitchens. Airlines and airports share a common goal of providing safe, convenient, and efficient air transport for passengers and cargo. Airlines and airports also have particular constraints and considerations that shape their operations, leading to recycling programs that are designed and implemented differently across airports and airlines. Examples of the factors that shape recycling systems include the following:

- The FAA regulates both airports and airlines and has rules that affect how materials are handled and stored on aircraft and at airports.
- Most airports are public entities, while airlines are typically publicly traded corporations.
- Tenant lease agreements, including those for airlines, are negotiated separately at each airport.
- Airlines' operations and lease goals differ by airport, due to hub locations, stakeholders involved, longevity of relationships, and use and location of flight kitchens.
- Some flight kitchens are operated directly by airlines, while others operate under contracts with multiple airlines; many flight kitchens are based at off-airport locations.
- Space limitations can pose constraints for sorting or storing materials for recycling on aircraft and at airports of all sizes.

These factors can pose challenges for providing the incentives and infrastructure needed to improve recycling systems. When airports, airlines, and flight kitchens work together, they can address many of these challenges and advance recycling within their own organizations and across the commercial aviation industry.



Successful partnerships for recycling focus on engaging and collaborating with key participants, including the following:

- Managers of airlines, airports, and flight kitchens
- Airline station managers
- Flight kitchen crews
- Cabin service crews
- Terminal maintenance personnel
- Waste and recycling collection companies
- Airline passengers

Typically, deplaned waste and recyclables are handled through one of two systems:

- An **airport-managed** system, in which cabin service crews or terminal maintenance personnel take materials to waste or recycling containers owned or operated by the *airport* or its contractor.



- An **airline-managed** system, in which one of the following occurs:
 - Flight kitchen crews take materials back to flight kitchens and in-house airline provisioning operations for handling, **or**
 - Cabin service crews place materials in containers owned or operated by the *airline* or its contractor.



At airports where recycling infrastructure is not available or easily accessible to airlines, airlines may back-haul or transport recyclables to another location with suitable recycling services. For example, Southwest, Delta, and Alaska Airlines may stow recyclables on board until planes reach an airport or provisioning location where the airlines' preferred recycling services are available.

The best practices identified in this guidebook are intended to fully utilize and expand on the existing airport- and airline-managed systems for handling waste and recyclables, as pictured in Figure 3.

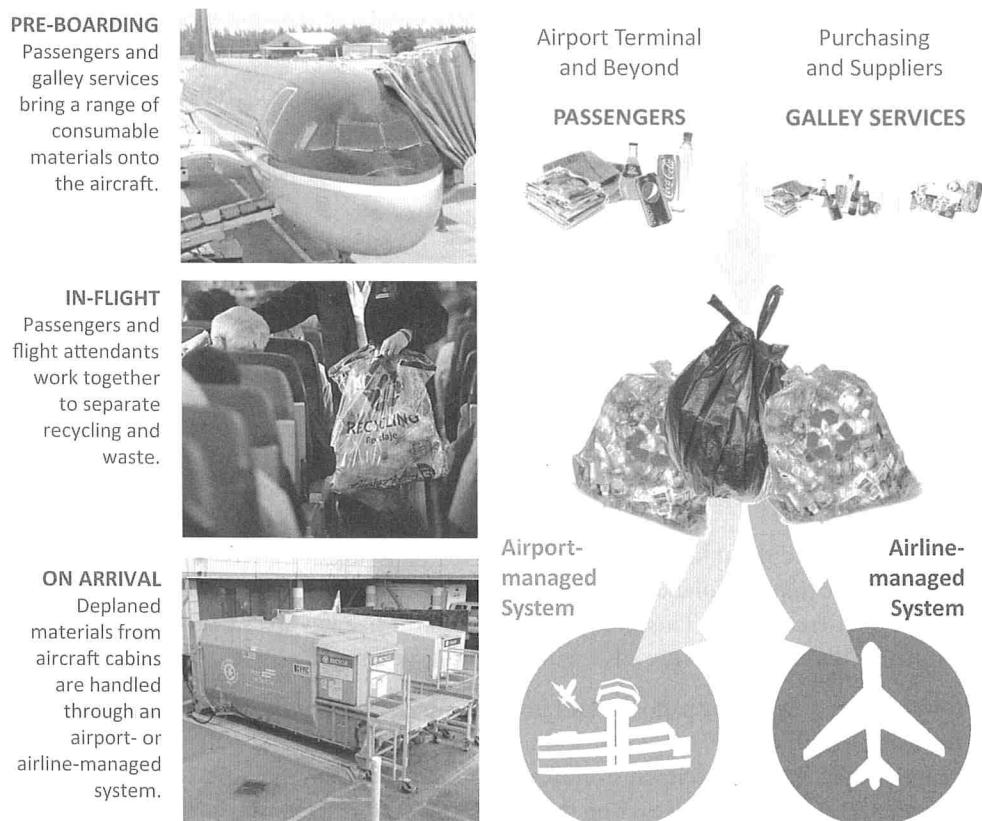


Figure 3. Handling materials deplaned from aircraft cabins through airport- and airline-managed systems.



Recycling Guidebook Overview

This guidebook is intended for individuals and organizations responsible for or interested in expanding recycling of deplaned waste at U.S. **airlines, airports, and flight kitchens**. Information about improving airport-wide and passenger terminal recycling strategies has been addressed elsewhere by the U.S. EPA, FAA, and others and is not a focus of this publication.¹³ This guidebook focuses on U.S. domestic flights, as regulations governing the handling of materials from international flights can make recycling more difficult.

The term **flight kitchens**, unless otherwise defined, is used broadly to cover all flight provisioning operations, including both contracted catering operations and in-house airline activities for providing food, beverages, snacks, and associated service items to aircraft. Definitions of other terms used in this guidebook are included in Appendix A.

Best Practices

Airlines, airports, and flight kitchens all influence the recycling of materials that enter aircraft cabins and the waste that is deplaned. Thus, best practices for recycling include activities undertaken by each of these parties. This guidebook focuses on five key **best practices**—identified through industry research—that are advancing aviation recycling across the country:

- Best Practice #1. Secure top-down and bottom-up commitment to boost recycling participation and results.
- Best Practice #2. Make purchasing choices that facilitate recycling and reduce waste.
- Best Practice #3. Maximize recycling by separating materials in flight.
- Best Practice #4. Track, evaluate, and share data on program performance to promote transparency and support continuous improvement.
- Best Practice #5. Make recycling part of everyday business and celebrate success.

These practices are intended to fully utilize and expand on the existing airport- and airline-managed systems for handling deplaned materials, described in the “A Partnership for Advancing Recycling” section, recognizing the variability in recycling services across the country.

Four recycling best practices summary sheets, included in Appendix B and available for download at www.trb.org/Main/Blurbs/169528.aspx, summarize key practices described in this guidebook for the following audiences:

- Airlines
- Large-hub and medium-hub airports

- Small-hub and non-hub airports
- Flight kitchens

Supporting Research

This guidebook is based on extensive research conducted from 2010 through 2012 with airlines, airports, and flight kitchens throughout the United States regarding existing systems and best practices for recycling materials from passenger aircraft. The research included the following:

- Analysis of surveys completed by 66 airports and 8 airlines¹⁴
- Field research visits to 11 airports of varying sizes, 6 major airlines plus their regional partners, and flight kitchens at selected airports
- A literature review, including more than 30 reports, journal articles, and other publications

Figure 4 shows a map of airports that participated in surveys and field research. Airlines that participated in the research are the following:

- Alaska Airlines
- American Airlines

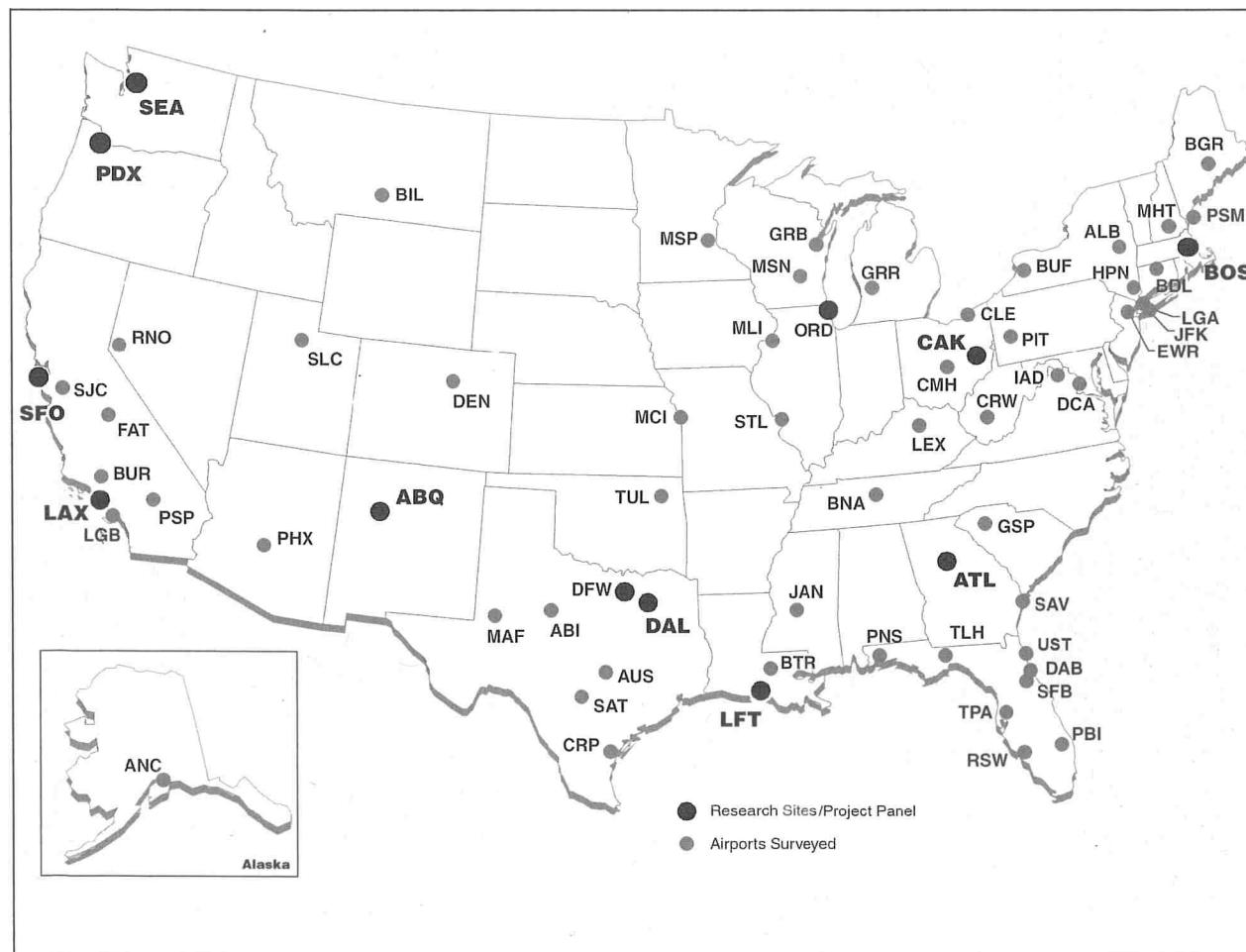


Figure 4. Map of airports that participated in surveys and field research.

- Great Lakes Airlines
- Delta Air Lines
- Southwest Airlines
- United Airlines
- US Airways
- Virgin America

The following flight kitchens also participated in the research:

- Gate Gourmet
- LSG Sky Chefs
- In-house airline provisioning operations at Southwest Airlines and Horizon Air (part of Alaska Airlines)

Appendix D provides more information on the research conducted under ACRP Project 02-15.



Best Practice #1. Secure Top-Down and Bottom-Up Commitment to Boost Recycling Participation and Results

Airline and airport recycling programs are often initiated by an individual champion or a small group of committed employees, such as a “Green Team.” Programs yielding the most impressive results have gained support, buy-in, and leadership across organizations where

- Recycling is a corporate value and norm.
- Employees take pride in contributing to and improving upon recycling programs.
- Executive leadership sets goals, tracks progress, and rewards success.

Why Is This Practice Important?

Executive leadership (top-down) and frontline employee commitment (bottom-up) have enabled airlines, airports, and flight kitchens to increase recycling throughout their organizations. Successful recycling programs rely on participation from individual employees and contractors. Every time someone handles a material, they can choose to recycle that item or dispose of it as waste.

Organizations that are recycling are reaping the following benefits:

- Cost savings from avoiding waste disposal
- Revenue from selling recyclable commodities
- Enhanced employee morale
- Improved environmental performance
- Positive customer feedback

Key Steps to Gaining Commitment

The following section explains three steps to gaining commitment from both executives and frontline employees at airlines, airports, and flight kitchens:

1. Gain support from executive leadership.
2. Recruit and empower champions.
3. Establish an interdepartmental Green Team.

Step 1: Gain Support from Executive Leadership

Executive-level support is a key to success in advancing recycling programs. In some cases, executive commitment to recycling has served as the inspiration and motivation for establishing specific recycling programs. In other cases, champions within airline, airport, and flight kitchen

Table 2. Key recycling benefits.

Financial	<ul style="list-style-type: none"> ▪ Captures cost savings from reducing quantities of waste disposal ▪ Generates revenues from selling valuable recyclable commodities, such as aluminum cans
Marketing	<ul style="list-style-type: none"> ▪ Meets increased customer demand for green services ▪ Keeps up with industry trends ▪ Avoids negative media coverage
Environmental	<ul style="list-style-type: none"> ▪ Reduces use of virgin materials, energy, water, and pollution associated with production of new materials ▪ Limits greenhouse gases, toxic chemicals, and other pollution associated with landfilling or incinerating waste materials

organizations have recruited executive sponsors by communicating the financial, marketing, and environmental benefits of a company-wide recycling program, including those summarized in Table 2.

Effective executive sponsors establish recycling as an organizational priority and set specific and aspirational goals. They also regularly communicate with employees, contractors, and passengers regarding organizational commitments and progress toward meeting stated goals.



Committed to Recycling

In 2007, Los Angeles Mayor Antonio Villaraigosa directed Los Angeles World Airports (LAWA) to develop a sustainability plan, which included goals related to recycling. As a result, the airport dedicated additional staff resources to oversee the recycling program. LAWA Deputy Executive Director of Environmental Services Roger Johnson established a goal to reach 70 percent airport-wide recycling by 2015.

Step 2: Recruit and Empower Champions

Successful recycling programs have benefited from enthusiastic employees and managers who

- Promote recycling to their coworkers and to others in the industry
- Provide ongoing training and troubleshooting assistance to other employees
- Bring new ideas forward to improve existing programs
- Report back to supervisors, managers, and other employees on progress in meeting goals
- Take personal responsibility for the success of the recycling program

Airlines, airports, and flight kitchens with successful programs recruit and cultivate program champions. These individuals may serve in frontline positions, such as flight attendants and airport recycling coordinators, bringing relevant insights for how to make a program work on the ground. Champions can provide leadership and coordination to the organization's

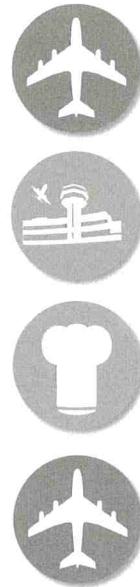
efforts: from designing and launching a recycling program, to refining and sustaining momentum over time.

Organizations with successful recycling programs have supported opportunities for recycling champions to share their ideas, successes, and excitement with others in the organization. Recognizing these recycling champions for their initiative and leadership through awards and other forms of public recognition supports program success.

Airlines can identify and honor recycling champions among flight attendants with “recycler of the month” awards, columns in in-flight magazines, or announcements in employee newsletters, blogs, and listservs.

Airports can recognize airlines, cabin service companies, terminal maintenance personnel, and flight kitchens for exceptional recycling participation through airport websites, annual reports, newspaper articles, and signage in passenger terminals.

Flight kitchens, like airlines, can acknowledge kitchen crews handling recyclables through “recycler of the month” awards and announcements in company communications.



Championing Success

Kathy Hues, Alaska Airlines onboard food and beverage specialist, was asked by her director to join Green Team meetings to determine how to start in-flight recycling. With the support of Alaska’s Green Team, Kathy championed in-flight newspaper recycling, which started in 2007. Alaska Airlines has since expanded the program to include aluminum cans, plastic and glass bottles, juice containers, paper coffee cups, plastic meal platters, and mixed paper.

Step 3: Establish an Interdepartmental Green Team

Airlines, airports, and flight kitchens with successful recycling programs often convene champions and other key representatives in Green Teams. These Green Teams typically include at least one representative from each major department. They meet regularly and are generally charged with the following responsibilities:

- Informing recycling and other environmental goals and targets approved or set by company leadership
- Developing, coordinating, and leading new environmental programs
- Reporting back to leadership on progress and lessons learned
- Celebrating and recognizing successes

Ultimately, Green Teams serve as a communication and management hub to keep activities coordinated, consistent, and cohesive.

More established Green Teams can develop a charter, vision statement, goals, and an annual work plan to keep the team focused and productive.

Whether formal or informal, Green Teams have served to kick-start new programs, improve on existing ones, and sustain momentum over time. In addition, Green Teams help to institutionalize recycling, ensuring that organization-wide commitment and programs continue beyond the involvement of founding champions and initial leadership.



Green Teams and Executive Commitment

Jackie Drumheller, Sustainability Manager, started Alaska Airlines' Green Team in 2007. Pilots, flight attendants, purchasing specialists, and administrators all participate on the team. In 2010, Alaska's CEO declared that "recycling is the standard" for the airline. Corporate, executive-level support was inspired, at least in part, by the Green Team's efforts.

During an October 2011 planning session, Alaska's Green Team executive sponsor Keith Loveless, Vice President for Legal and Corporate Affairs, communicated that one of the company's focus areas in the next 5 years was to "position Alaska Airlines as the industry leader in environmental stewardship." The airline's receipt of several business and environmental awards in recent years highlights its progress.



Best Practice #2. Make Purchasing Choices that Facilitate Recycling and Reduce Waste

Recycling is more efficient and effective when service items—including beverage cups, containers, and food packaging—are designed and purchased with recycling in mind. **Airlines, airports, and flight kitchens with successful recycling programs are integrating environmental and sustainability criteria into the procurement process** to support recycling of service items and to meet growing customer demand for green services.

In this guidebook, **service items** include durable and disposable cups, napkins, utensils, snack boxes and wrappers, and other materials distributed to airline passengers during food and beverage service. Service items also include items used in service but not distributed to passengers, such as bulk juice or water containers as well as aluminum beverage cans.

Airports with bold recycling commitments are working with concessionaires located in terminals to support greener purchasing practices that align with airport and airline recycling programs and that reduce waste. Major industry suppliers have expanded their selection of recycled-content, recyclable, compostable, and other environmentally preferable service items. In recent years, **cost and performance of environmentally preferable products have greatly improved** due to substantial increases in demand and technology innovations.



Why Is This Practice Important?

Airlines, airports, and flight kitchens purchasing recycled-content, recyclable, compostable, and other environmentally responsible service items are experiencing benefits such as the following:

- Lowering waste disposal costs as more materials can be shifted from the waste container to the recycling (or compost) container
- Reducing product costs and contributing to the development of better-performing products and a greater variety of environmentally responsible product options offered by suppliers
- “Closing the loop” by increasing the supply of materials to make recycled-content service items and demonstrating demand by purchasing them

Key Steps to Green Purchasing

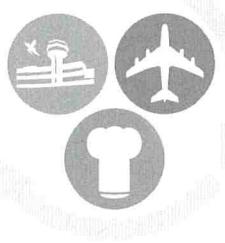
This section explains four steps to making purchasing choices that facilitate recycling and reduce waste for airlines, airports, and flight kitchens:

1. Consider recyclable, compostable, or waste-reducing service item options.
2. Test environmentally preferable products and develop specifications for procurement.
3. Share best practices with others.
4. Support procurement departments in incorporating green purchasing.

Step 1: Consider Recyclable, Compostable, or Waste-Reducing Service Item Options

Airlines, airports, and flight kitchens with successful recycling programs work collaboratively with suppliers and peers to explore service item options that are designed to be recycled, composted, reused, or that use less material altogether, resulting in less waste. Some purchasing standards reference independent certifications to inform product choices, such as Biodegradable Product Institute (BPI)—certified compostable products.

Airlines and flight kitchens can work with airports and waste and recycling contractors to ensure that specific products are recyclable at most or all locations. Some airports support airlines, flight kitchens, and concessions located in their terminals by providing resources on recyclable and compostable products. Table 3 shows examples of products with various environmental features.



Southwest Airlines replaced its Styrofoam™ coffee cup with a paper cup containing 12 percent post-consumer recycled content. Southwest is actively working with its national recycling contractor to identify recycling options for the 14 million cups used each year.

Table 3. Environmentally preferable purchasing guidelines.

Feature	Examples	Notes
Recycled Content	Napkins, paperboard, selected beverage packaging containers	Look for post-consumer recycled-content products and paper products containing at least 30 percent recycled content.
Recyclable	Newspaper, cardboard, most beverage containers, mixed paper, selected beverage cups	Check with local recyclers, as markets vary by region, and determine which items can be accepted for recycling.
Compostable	Napkins, selected beverage cups, selected utensils	If you are separating materials for composting, look for BPI-certified products and make sure your compost processor accepts them.
Reusable	Headsets, service ware	Offer reusable headsets for in-flight entertainment. Where feasible, serve meals with durable service ware, including dishware and utensils.
Less Waste	In-flight snack packs, beverage service	Minimize separate or duplicative packaging of snack pack contents. Consider bulk dispensing for beverage service.

Step 2: Test Environmentally Preferable Products and Develop Specifications for Procurement

Airlines and flight kitchens can engage in test runs to ensure that products meet performance standards before adopting new products. **Major suppliers often offer cost breaks for products used during trial periods.**

Airlines and flight kitchens can solicit feedback on service items throughout their organization, including from employees and customers. Suppliers may be able to work with product manufacturers to improve the design and performance of specific service items.

Ideally, airlines and flight kitchens work together with suppliers to improve product availability and quality and to drive down unit costs. Airlines and flight kitchens can also establish green purchasing cooperatives to achieve these goals.

Based on the results of the testing process, organizations can develop product specifications and integrate them into procurement requests for proposals and contracts.

Airports can work with recyclers to ensure that service items are recyclable or compostable in local markets.



Dale Reighter, Los Angeles Area General Manager for LSG Sky Chefs, notes, "Our procurement department is ready and able to help clients investigate and source recyclable and compostable products for flights. We also see opportunities for our airline customers to use lightweight alternatives and scale provisioning amounts to the number of passengers onboard."

Step 3: Share Best Practices with Others

Airlines, airports, and flight kitchens that successfully transition to environmentally preferable products can share their experiences, lessons learned, and recommendations with their colleagues and across the industry. **In addition to peer-to-peer communications, organizations can present information at conferences and in industry publications** sponsored by industry groups, such as Airports Council International (ACI), American Association of Airport Executives (AAAE), and Airlines for America (A4A).

Airports, airlines, and flight kitchens can share new product offerings and features with passengers through the following:

- In-flight menu cards and service item descriptions in in-flight magazines
- Frequent-flyer emails and newsletter updates
- Information printed on individual service items
- The general media

Step 4: Support the Procurement Department in Incorporating Green Purchasing

Airlines and flight kitchens can support procurement personnel in taking green purchasing to the next level for in-flight service items as well as for all products procured for business operations.



An example is for environmental managers to offer purchasing managers training and tools for assessing the total costs of specific products, from procurement through disposal.

Total cost accounting is a way to consider the cost of a product throughout its use and disposal—adding recycling and disposal costs to the factors already considered, such as purchase price, transportation, labor, storage, weight and jet-fuel implications, and suitability for altitude changes.

Airlines and flight kitchens can provide purchasing staff with educational training and tools to estimate, assess, and compare products based on total costs throughout their use and disposal.



Recycling Beyond In-Flight Service

Instead of being disposed of in landfills, old floor coverings from American Airlines' jets are being recycled into new carpet and installed on new Boeing aircraft manufactured near Seattle.

American Airlines donates used pillows and blankets to homeless shelters. Old carpet from planes is also provided to animal shelters, while old aircraft windows are made into polycarbonate pellets for manufacturing into new products.



Best Practice #3. Maximize Recycling by Separating Materials in Flight

Flight attendants collect the vast majority of waste materials generated in flight by passengers and can therefore play a central role in maximizing recycling from aircraft cabins by collecting and storing materials on the plane before descent. Upon landing, cabin service and flight kitchen crews can then transport deplaned materials to appropriate containers for recycling and disposal. Separating recyclables on the ground after they are mixed with waste is more costly and time-consuming.

Different methods can be used to effectively collect and store materials in flight. When an airline is responsible for managing its own waste and recycling, it makes sense for the airline, its flight kitchens, and cabin service crews to work together to develop a consistent system that works best for them, resulting in better recycling results and lower labor costs.

When an airport is responsible for managing airline waste and recycling, the airport can work together with airlines to develop a system that is consistent across airports, allowing for more streamlined in-flight separation of recyclables.



Why Is This Practice Important?

Separating recyclables in flight makes recycling feasible at the airport or flight kitchen. At most airports, if materials are not separated in flight, little opportunity exists for recycling due to the time and cost associated with separating recyclables after they have been mixed with waste.

In-flight separation maximizes the market value of recyclables by

- Increasing the quantity of recyclable materials collected
- Reducing the contamination of recyclable materials with non-recyclable waste

Separating waste materials in flight is also a highly visible way to demonstrate an organization's environmental commitment.

American Airlines works with flight attendants to collect and stow aluminum cans on beverage carts for recycling, while other materials are collected separately in designated garbage bags.

At Alaska Airlines, "Turbulence or medical emergencies are the only things that should limit flight attendants from recycling in flight," says Kathy Hues, onboard food and beverage specialist.

Key Steps to Successful In-Flight Separation

This section presents five steps to maximize recycling by separating materials in flight:

1. Design a recycling program with input from key participants.
2. Implement consistent procedures for collecting and storing recyclable materials in flight.
3. Ensure that flight attendants have adequate information, training, and support.
4. Equip flight kitchen, cabin service, and terminal maintenance personnel to contribute to an effective recycling program.
5. Engage and educate passengers early and often.



In-Flight Recycling

Several airlines—including Delta, Alaska, and Southwest—are using transparent, clearly marked bags for recyclable materials. The bags help distinguish recyclables from garbage and help promote recycling efforts to passengers. Some airlines feature their logos on their recycling bags.

Virgin America is in the process of testing galley carts with separate compartments for collecting recyclables and garbage.

Step 1: Design a Recycling Program with Input from Key Participants

Both airport-managed and airline-managed recycling programs benefit from in-flight separation of recyclables from garbage. Involving key participants from all sectors is critical for designing a recycling program built on appropriate and workable in-flight procedures. Table 4 lists some key participants to involve.

Gathering input from key participants helps ensure that in-flight procedures support the goals of the recycling program, maximize cost savings and efficiency, and are workable.

Table 4. Key participants to involve in designing a recycling program.

Airports 	<ul style="list-style-type: none"> – Terminal maintenance personnel, including supervisors and employees – Custodial managers and employees – Facilities managers – Real estate departments (regarding contracts with airlines)
Airlines 	<ul style="list-style-type: none"> – Flight attendants and supervisors – Cabin service crew supervisors and employees – Facilities managers – Environmental, health, and safety managers – Purchasing managers – Representatives from contract carriers
Flight Kitchens 	<ul style="list-style-type: none"> – Employees handling deplaned waste materials – Facilities managers

Key participants can provide input on specific elements of program design:

- Flight attendants and flight kitchen staff can help to identify materials to be collected in flight.
- Flight attendants can help to develop consistent procedures for collecting and storing recyclables in flight.
- Airport managers, flight kitchen staff, cabin service crews, and terminal maintenance personnel can help to establish processes for transporting materials from the aircraft to appropriate recycling facilities at the airport or flight kitchen.
- Accounting staff can help determine the costs, savings, and potential revenues associated with the recycling program.

Early and close collaboration with partners creates a strong foundation for recycling programs.

Step 2: Implement Consistent Procedures for Collecting and Storing Materials in Flight

Airlines are likely to take the lead in this process as they set standard procedures for in-flight safety and passenger service, including handling recyclables and waste materials in flight. Airlines with successful programs have instituted consistent procedures across their organizations. Flight attendants are often involved in determining recycling procedures best suited for their company. Key activities include identifying materials that can be recycled from all or most flights, determining opportunities for consistent collection and storage procedures across flights, and establishing where recyclables will be stored in flight and for landing. Each of these activities is discussed below.

Identifying Materials that Can Be Recycled from All or Most Flights

Materials recycled at many airports include aluminum cans, mixed paper, cardboard, and plastic bottles. Figure 5 shows the reported availability of recycling services at 66 airports surveyed for this project. Airlines can work with airports, purchasing departments, flight kitchens, contract carriers, flight attendants, and cabin service crews to address service items and other materials purchased or brought on board by passengers. Airlines can focus first on capturing the most commonly recycled materials and later on incorporate items that are recycled in selected

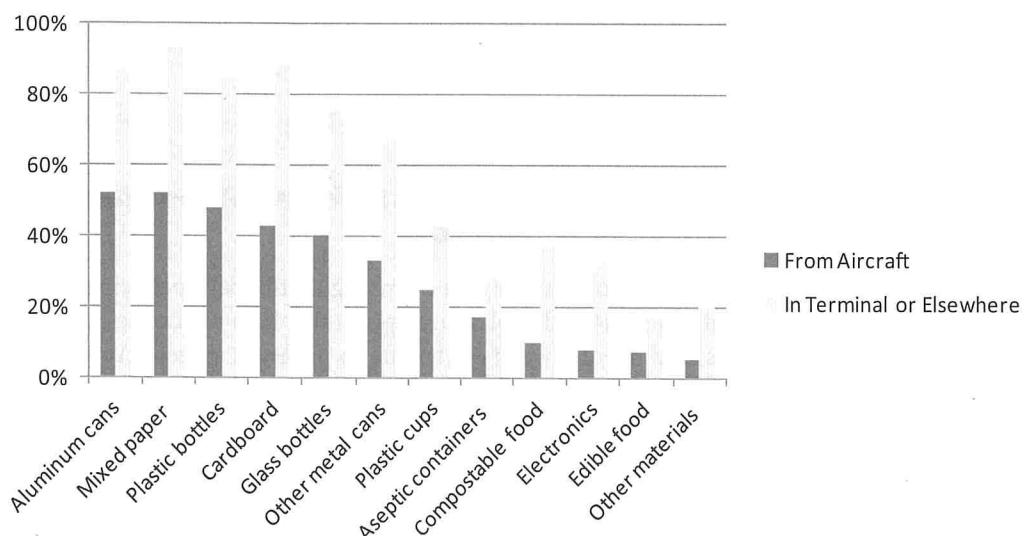


Figure 5. Availability of recycling collection at airports (as reported in surveys).



locations, such as beverage cups, plastic film, and food scraps. Suggested approaches to this activity for airlines and airports are the following:

- **For airline-managed** systems, focus first on capturing the most commonly recycled materials and then address items with more limited recycling options, as feasible.
- **For airport-managed** systems, airports can target materials for recycling through the airport's recycling collectors, while working with other airports and airlines to maintain a consistent system across multiple locations.

Determining Opportunities for Consistent Collection and Storage Procedures across Flights

In most in-flight recycling programs, flight attendants collect mixed recyclables in designated bags. Aluminum cans and other beverage service items that are not distributed to passengers often stay on galley service carts for collection. Best practices include the following:

- Using clear bags labeled with a recycling symbol, label, and the airline's logo is particularly effective.
- Airlines typically purchase the bags, and flight kitchens provide them to each flight.
- Flight attendants may collect recyclables and waste from passengers using a galley cart immediately after food or beverage service and carry bags by hand prior to descent to collect recyclable materials remaining in the cabin.

Establishing Where Recyclables Will Be Stored in Flight and for Landing

Some airlines store empty aluminum cans for recycling on trays in beverage carts. Others place bagged recyclables on top of or inside empty service carts along with (but not inside) waste bags. Making it a standard procedure to keep bags of recyclables separate from waste bags and to have them clearly marked as recyclable supports effective recycling; otherwise, recyclables run the risk of being disposed of as waste.

Several airlines with successful recycling programs have developed creative solutions for in-flight separation. For example, Southwest Airlines, which does not use service carts, often stores bagged recyclables in unused wheelchair stowage compartments. The airline received FAA approval for this storage method on flights when the area is not needed for a wheelchair.

Airlines can communicate with flight attendants about their specific suggestions for efficiently and consistently collecting and stowing recyclable materials.

Step 3: Ensure that Flight Attendants Have Adequate Information, Training, and Support

Successful aircraft cabin recycling programs rely on active flight attendant participation and support. Airline managers and supervisors also play an important role in educating attendants on program goals, procedures, and how they can contribute to program success. Airports can reinforce program success through regular recycling updates and printed materials that can be posted in flight attendant break rooms and administrative areas.

Airlines with successful recycling programs often educate flight attendants through the new employee orientation and on-boarding process. Recycling guidelines and goals can be integrated into employee manuals. Ongoing training and education are often accomplished through methods such as the following:

- Email updates
- Employee blogs
- Regular meetings and conference calls
- On-the-job training by other flight attendants

Training for Success

Delta Air Lines flight attendants are introduced to recycling policies and standards at the beginning of their tenure and updated through frequent communication from airline management. Delta also provides information on airport-specific recycling instructions through flight attendants' pre-clearance reports on each flight.

Virgin America provides flight attendants with an introductory training upon hiring, plus biweekly conference calls to introduce new recycling policies, among other topics.



Step 4: Equip Flight Kitchen, Cabin Service, and Terminal Maintenance Personnel to Contribute to an Effective Recycling Program

The diversity among airports—and in airport/airline relationships—makes some variation in how deplaned recyclables are handled on the ground inevitable. Airlines with successful recycling work with airports and flight kitchens to tailor programs for various locations, while maintaining the overall consistency of in-flight procedures as much as possible. Airlines and airports must **work closely with the crews removing and handling materials from aircraft cabins**, whether they are flight kitchen crews, cabin service crews, or terminal maintenance personnel. Key activities include ensuring that appropriate procedures are in place for keeping deplaned recyclables separate, providing the infrastructure and information needed to support proper recycling of deplaned materials, and providing training for crew members and managers. Each of these activities is discussed below.

Ensuring that Appropriate Procedures Are in Place for Keeping Deplaned Recyclables Separate

It is important that there are procedures for separating recyclables from waste and for transporting them properly to the appropriate containers. In successful recycling programs, all parties involved in the removal and handling of recyclable materials from an aircraft are aware of the proper procedures for removing materials from the aircraft, transporting them, and depositing them in the proper containers. Without these procedures in place, recyclables may not reach the appropriate location for recycling at the airport or flight kitchen, and the value of in-flight separation of recyclables could be lost.

In airline-managed systems, airlines work directly with flight kitchen and cabin service crews at each location to create efficient procedures for moving and handling recyclable materials—from inside the plane, to the ramp, and to the final collection container.

In airport-managed systems, airports work with airlines, their flight kitchen or cabin service crews, and with terminal maintenance personnel to ensure that all parties involved are clear about their recycling roles and responsibilities.



Providing the Infrastructure and Information Needed to Support Proper Recycling of Deplaned Materials

Successful recycling programs rely on proper infrastructure to keep recyclable materials separate and clean during collection, transportation, and disposal.



Airports can support successful recycling programs by providing recycling and waste containers that are conveniently located, clearly labeled, and color-coded for easy identification by users. Airports can gain input on preferred locations from the crews handling and depositing materials in containers on the airfield. When airports co-locate recycling and waste containers, users always have a recycling (and disposal) option available. Providing airlines with detailed maps of airport recycling and waste management infrastructure, including the location of all dumpsters and recycling containers, also supports recycling efforts. See an example map from Sea-Tac International Airport in Figure 6.

Airports often need to obtain airline permission before placing recycling bins in areas that airlines are leasing. Airports and airlines can work together to adjust lease terms, if necessary, to enable proper placement of recycling containers.

Providing Training for Crew Members and Managers

Airlines and airports can partner to provide ongoing education and training for crew members or supervisors responsible for implementing the recycling procedures.

Airlines can provide training to cabin service crews on collecting recycling from aircraft cabins. For example, service crews may be trained to carry recycling and waste bags together

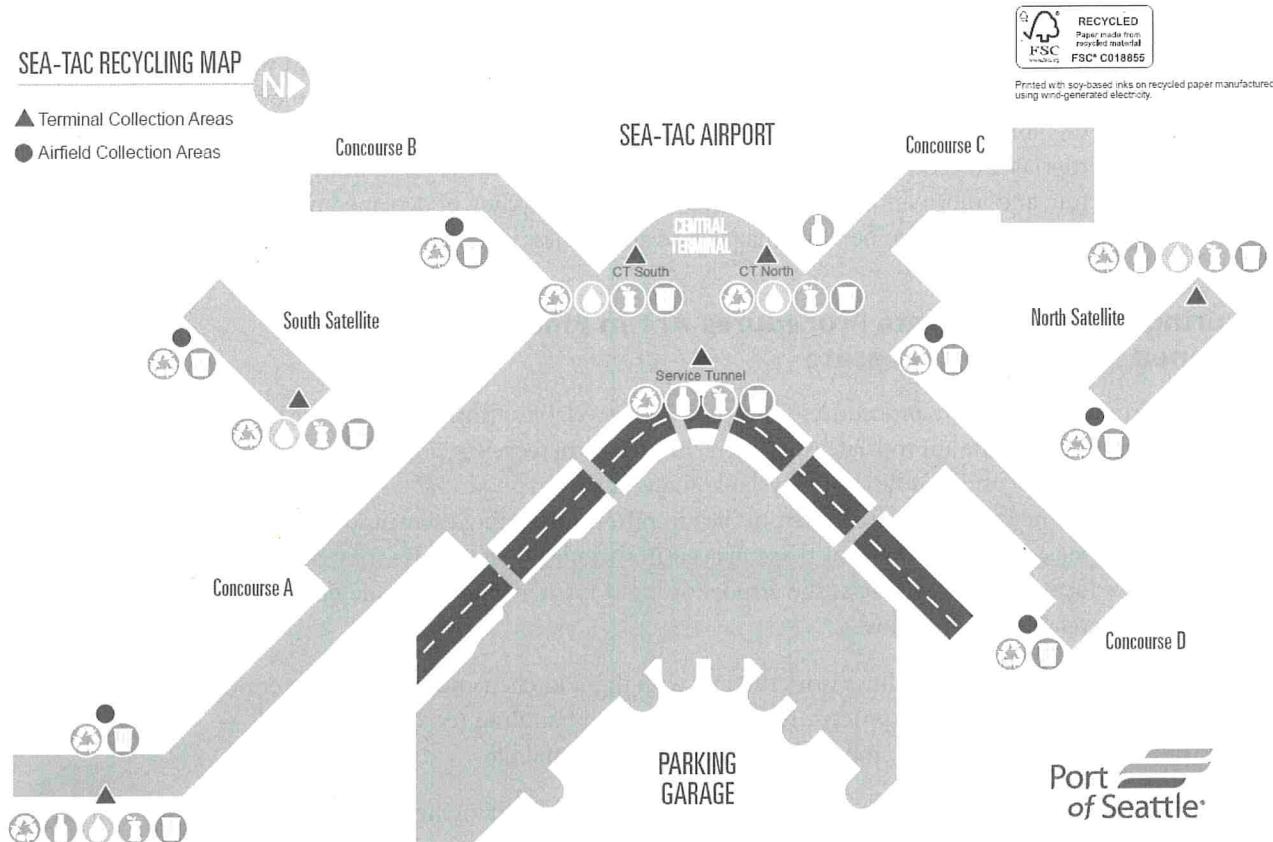


Figure 6. Example map of airport recycling infrastructure (from Sea-Tac International Airport).

while collecting discarded materials to maximize efficiency. Using differently colored and labeled bags for recyclables and garbage also supports successful recycling. Airlines and airports can coordinate to ensure that the materials collected are able to be recycled at the receiving airport.

Airports can provide training to terminal maintenance personnel who receive waste materials at the gate regarding proper transport to airport-managed waste and recycling containers.

Flight kitchens can engage and train employees on recycling practices. They can train their transportation crews on how to identify and transport recyclables from the aircraft to the kitchen and make sure that the dish-room crews know how to identify and direct recyclables to appropriate containers when the used service carts enter the kitchen.



Step 5: Engage and Educate Passengers Early and Often

Involving passengers in in-flight separation not only helps increase the effectiveness of recycling programs; it can also help build customer loyalty. Airlines and airports with successful programs often educate passengers with recycling messages at the terminal, at the boarding gate, and on the plane. These messages can reinforce understanding and prompt recycling behavior.

Airports that provide recycling service for materials deplaned from aircraft can post messages or signs in terminals describing the collaboration between the airport and airlines.

Airlines can advertise their commitment to recycling and describe the recycling services they provide through in-flight magazines, menu cards, and video screens. Airlines with successful in-flight separation programs can have flight attendants make announcements with relevant instructions for passengers prior to collection of recyclable materials.

Some flight kitchens, often at airlines' direction, have added recycling logos and messages on menus or other service items to provide additional education to passengers.



Delta Air Lines plays short recycling messages alongside music over aircraft audio systems as passengers board and exit the aircraft. The airline also promotes its in-flight recycling program and "100% recycling goal" through messages on seat-mounted video displays.



Best Practice #4. Track, Evaluate, and Share Data on Program Performance to Promote Transparency and Support Continuous Improvement

You can **manage what you measure**. Airlines, airports, and flight kitchens with successful recycling programs work collaboratively to obtain and track information on recycling progress and opportunities. They monitor the quantities and composition of recyclable and waste materials collected from aircraft cabins, associated costs and revenues, and opportunities to further reduce waste and increase recycling.

Why Is This Practice Important?

Airlines, airports, and flight kitchens with successful programs are using recycling and waste information to track their performance against program goals, to measure cost savings that result from reducing waste and increasing recycling, and to ensure that participants benefit from the recycling program's achievements. These leading organizations are also refining and improving their programs based on their findings and sharing their findings with colleagues to promote transparency and advance recycling throughout the commercial aviation industry.

Key Steps to Tracking and Evaluating Program Performance

This section presents five steps for airlines, airports, and flight kitchens to track and evaluate program performance and to share findings, promote transparency, and support continuous improvement:

1. Conduct a baseline waste assessment.
2. Work with waste and recycling service providers to obtain monthly program reports.
3. Track and share data on program performance and identify opportunities for improvement.
4. Align price signals with program performance so that participants can benefit from recycling achievements.
5. Share results with colleagues to foster transparency, leadership, and partnerships across the industry.

Step 1: Conduct a Baseline Waste Assessment

A baseline waste assessment analyzes the types and quantities of waste and recyclable materials generated by employees, contractors, and passengers. These assessments can range from visual observations of bagged materials collected in flight to large-scale waste characterization studies conducted by an independent party.

Airlines can use baseline waste assessments to determine how much recyclable material is present in their waste, which is important for setting program diversion goals and for determining collection service levels.

Once recycling programs are underway, waste assessments may be conducted periodically to monitor program performance.

Airlines, airports, and flight kitchens can scale the approach to best meet their needs and available resources. Some organizations, like Alaska Airlines, host waste assessment events several times a year to collect valuable data on their recycling progress and opportunities, while engaging and informing employees.

Appendix C describes the basic steps in a waste assessment and includes a sample waste assessment guide.

Ultimately, the results of the waste assessment can support the following outcomes:

- Measuring progress against established goals and setting new ones
- Focusing attention on key materials with significant recycling or waste prevention potential
- Aligning costs and savings more closely with waste and recycling quantities
- Raising awareness of recycling throughout the organization and the aviation industry at large



Alaska Airlines has conducted regular waste assessments of its in-flight materials several times a year since 2007. Waste from approximately 30 flights is analyzed as part of each assessment. Alaska includes the company's contracted flight kitchen facilities, LSG Sky Chefs, in the assessments. In 2011, the airline collected 48 percent of recyclable material generated (by weight), according to waste assessment results.

Delta Air Lines has worked hard to keep its recycling separate from airport streams because tracking and reporting annual recycling amounts is an essential part of the airline's success. At LAX, for example, Delta's cabin service contractor removes bagged recyclables from in-flight service and transports them to recycling containers located at Delta's provisioning warehouse on the airfield. Delta receives reports from its recycler on the types and quantities of materials recycled, and the airline shares this information with the airport.

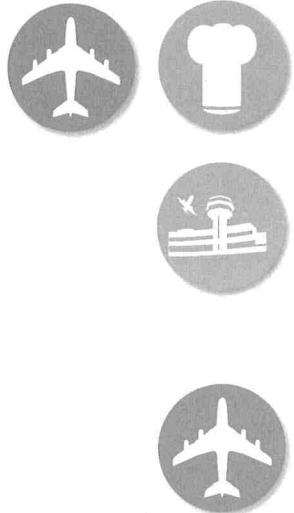
Southwest Airlines contracts with a national waste and recycling company that provides the airline with regular reports on the quantities of cans, bottles, cardboard, and mixed paper recycled from flights.

Los Angeles International Airport tracks the types and quantities of materials recycled through its airport-wide program. The airport also works closely with its tenants to track their recycling progress.

Portland International Airport (PDX) has helped airlines such as Delta and Alaska to better understand their in-flight waste through regular waste assessments. Airport management estimates that about 50 percent of this waste could be recycled through current airport-provided programs.

Step 2: Work with Waste and Recycling Service Providers to Obtain Monthly Program Reports

Some airports, airlines, and flight kitchens request or require their waste and recycling service providers to provide them with quantity and cost information on a monthly basis.



Under **airline-managed systems**, airlines can work directly with waste and recycling service providers to obtain data on materials collected in airline-controlled containers on the airfield. Airlines can also collaborate with flight kitchens to obtain data on airline-specific materials disposed of or recycled at flight kitchen facilities.

Obtaining airline-specific data under **airport-managed systems** can be more challenging. Airports can support successful recycling programs by establishing mechanisms for tracking or estimating airline-specific information. This tracking can be done by providing each airline with designated recycling containers or by apportioning total airline-generated materials according to passenger counts, numbers of flights, or specific gates used—and sharing it with airlines on a monthly, quarterly, or annual basis.

Airlines, such as Southwest or Alaska, that contract with national recycling collection companies regularly obtain detailed information on waste and recycling quantities, container sizes, and collection frequencies, and the associated costs and revenues. These airlines compile the information into a tracking spreadsheet to closely monitor their progress against goals and costs.

Use of compacting containers can also reduce waste disposal and recycling costs by lowering collection frequencies.

Southwest Airlines has a national contract with Republic Services to provide recycling (and sometimes garbage) collection services at its provisioning stations around the country. Republic was selected through a competitive bid process.

Debbie Neel, Southwest's Facilities Maintenance Programs Manager, credits Republic, saying "Without them, the company's recycling program wouldn't have even gotten off the ground."

Republic Services provides Southwest with monthly reports on quantities of garbage and recycling, costs, and other service-related information. Southwest uses these data to track the company's recycling progress.

The airline also receives reports from its recycler on the types and quantities of materials recycled. At Los Angeles International Airport, Southwest reports this information to the airport to comply with California's statewide recycling reporting requirements.

Delta also shares recycling performance data with corporate management, flight attendants, cleaning crews, and others, which helps build support for the recycling program.

Step 3: Track and Share Data on Program Performance and Identify Opportunities for Improvement

Airports, airlines, and flight kitchens with the most effective recycling programs regularly monitor key performance metrics, such as the following:

- Per-passenger waste and recycling quantities
- Recycling rate or material-specific capture rates

- Per-ton costs or revenues for waste disposal and recycling
- Presence of recyclables in disposed waste

Under **airline-managed systems**, airlines can combine data on quantities collected from flight kitchens or recycling service providers with airline information on passenger counts to determine per-passenger quantities for tracking purposes. Airlines, in partnership with flight kitchens, can also use periodic waste and recycling assessments to estimate recycling and capture rates and to identify recyclables remaining in disposed waste. (For more information on conducting waste assessments, see Step 1 above and Appendix C.) Alternatively, airlines can use flight kitchen estimates of quantities of food, beverage, and service items used to estimate total amounts of waste disposal and recycling for individual flights or groups of flights.



Effective tracking under **airport-managed systems** requires collaboration between airports and airlines. Airports can use dedicated waste and recycling containers to track airline-specific quantities and costs. By tracking and sharing airline-specific data, airports can provide airlines with valuable information about program performance as well as promote transparency. Airports and airlines can also use these data to inform lease agreements and pricing structures for airport-provided recycling and waste management services.



Monitoring Recycling Program Performance

According to the *Delta 2009 Corporate Responsibility Report*, Delta Air Lines recycled nearly 60 percent of its waste, which included 500 tons of paper, 200 tons of aluminum, and 100 tons of plastic. This figure represented a 22 percent jump from the program's inception in 2007.

Los Angeles International Airport regularly tracks quantity information for recycled materials and works closely with tenants who recycle independently to obtain comparable data for their programs. The airport then aggregates this information and submits a report to the city every year as required under California state law.

Step 4: Align Price Signals with Program Performance so that Participants Can Benefit from Recycling Achievements

Recycling programs can deliver substantial cost savings in the form of avoided waste disposal costs. These cost savings can provide a strong motivation for companies to implement and improve recycling programs.

Airline waste disposal costs are often bundled with other fees into a lease agreement with an airport or in a contract with a flight kitchen. **Airlines, airports, and flight kitchens** can work together to align waste disposal costs with quantities of waste and recycling produced. This alignment can be accomplished by making the costs of waste disposal a separate line item in lease agreements or by making service costs sensitive to the quantities of waste and recyclables collected. This arrangement creates a direct financial incentive to reduce waste and maximize recycling.

Lease and contract negotiations are typically handled by departments not involved in waste management and recycling. **Airlines, airports, and flight kitchens** with successful recycling programs are proactive about educating departments and offices within and across their organizations on the benefits and cost savings created through recycling.

Seattle-Tacoma International Airport charges airline tenants custom rates for waste disposal service, using waste quantity data that are estimated for each airline, based on compactor usage. Airlines and other tenants use key cards to access waste and recycling dumpsters on the airfield. The key card system transmits usage data back to airport recycling managers, who use these data to determine the custom rates. Sea-Tac provides an annual notification to each airline that identifies its recycling rate, monthly fee for garbage, and savings associated with recycling.

Step 5: Share Results with Colleagues to Foster Transparency, Leadership, and Partnerships across the Industry

Leading airports and airlines are sharing their successes and lessons learned with peers at industry conferences and in publications. Links to some of these conference presentations and publications are included in Appendix C.

Data from individual recycling programs can be used for benchmarking performance and informing industry-wide changes needed to advance recycling nationally. For example, some airports and airlines are seeking ways to align price signals for waste and recycling collection services, which are often embedded in lease agreements or service contracts, with recycling program performance. Sharing individual program experiences addressing this challenge, as well

Table 5. Cross-industry collaborations.

Participants	Key Activities
West Coast Airport Recycling Group <ul style="list-style-type: none"> • Anchorage International Airport (ANC) • Denver International Airport (DEN) • Los Angeles World Airports (LAWA/LAX) • Oakland International Airport (OAK) • Phoenix Sky Harbor International Airport (PHX) • Portland International Airport (PDX) • Reno-Tahoe International Airport (RNO) • San Diego International Airport (SAN) • San José International Airport (SJC) • San Francisco International Airport (SFO) • Seattle-Tacoma International Airport (SEA) • Tucson International Airport (TUS) • Vancouver International Airport (YVR) 	This recycling group of 13 western airports supports airline efforts to develop in-flight recycling programs and coordinates across airports. The group also conducted a survey to identify current recycling services available at participating airports.
Alaska Airlines and Virgin America	At West Coast flight kitchens for Alaska Airlines and Virgin America, Alaska allows Virgin America to use its containers to recycle aluminum cans, mixed paper, and plastic materials from Virgin America galley carts at no cost to Virgin America or the flight kitchens.
Sustainable Airport Manual and “Airports Going Green” Conference	The City of Chicago Department of Aviation convened dozens of commercial aviation industry leaders to share best practices, lessons learned, and case studies of airport sustainability initiatives, resulting in a draft of the “Sustainable Airport Manual.” The City also hosts an annual “Airports Going Green” conference for industry partners.

as program results, promotes transparency in relationships between program partners. Airlines, airports, and flight kitchens that develop successful approaches can assist others in the industry by sharing their methods, including details, such as how per-passenger waste costs are determined, and how programs can effectively achieve cost savings.

Leading airlines, airports, and flight kitchens can go beyond individual programs to actively collaborate within their industry to advance recycling on a national scale.

These collaborations solidify the longevity and legitimacy of individual recycling programs, catalyze further innovation, and help to educate other members of the industry on recycling best practices. Selected examples of cross-industry collaboration are presented in Table 5.



Best Practice #5. Make Recycling Part of Everyday Business and Celebrate Success

Successful recycling programs rely on active and ongoing participation from employees, management, contractors, and passengers. Airlines, airports, and flight kitchens with successful programs make recycling part of everyday business by providing these participants with the education, training, and institutional support needed to sustain momentum and high performance. They also recognize participants' efforts and share program achievements with other stakeholders and the public.

Why Is This Practice Important?

Education, training, and institutional support for recycling serve to build awareness, buy-in, coordination, and consistency for recycling participants. The result is recycling programs with longevity, as well as higher levels of participation, improved efficiency, increased revenue, and reduced disposal costs. By publicly recognizing participants' efforts and sharing program achievements, organizations demonstrate their commitment to recycling and green business practices.

Key Steps to Make Recycling Part of Everyday Business and Celebrate Achievements

This section presents four steps for airlines, airports, and flight kitchens to make recycling part of everyday business and celebrate success:

1. Incorporate recycling into new and ongoing employee training.
2. Embed recycling expectations into service standards and contracts.
3. Recognize and reward employees and other program participants who contribute to recycling.
4. Share results and celebrate achievements with program participants and the public.

Recycling as a Part of Everyday Business

Albuquerque International Sunport management has initiated mandatory monthly trainings for employees on the subject of recycling and sustainability. Training also takes place when a new initiative is launched that relates to recycling or sustainability.

Alaska Airlines flight attendants share recycling best practices and updates through a company-wide email listserv.

Step 1: Incorporate Recycling into New and Ongoing Employee Training

Airlines, airports, and flight kitchens with successful recycling programs have incorporated recycling education into the new employee on-boarding process. By doing so, **they are demonstrating that recycling is an everyday business practice, a company priority, and a norm.**

The following are examples of topics that can be included in new employee training:

- Sustainability and environmental commitments and goals
- Overview of programs, awards received, and waste reduction or cost savings achieved
- Review of specific materials covered by the recycling program
- Collection and handling procedures specific to each position, including flight attendants, cabin service crews, terminal maintenance personnel, and others
- Opportunities for further engagement, such as Green Teams and email listservs
- Recognition and awards the organization has received

Regular and ongoing training is critical to sustaining participation; coordinating efforts over time; and providing updates on corporate priorities, new materials, and procedures. Successful recycling programs foster ongoing engagement with employees, managers, and contractors using many different approaches, such as the following:

- On-the-job training and coaching from supervisors and managers
- Updates at regular station or staff meetings
- Posts on email lists and blogs or in employee break rooms
- Employee newsletter articles
- Green Team meetings or communications

Leading airlines and airports have also initiated interdepartmental Green Teams to engage motivated employees and managers, coordinate efforts across the organization and industry, and inform program developments. Please see the Best Practice #1 section for more details about Green Teams.

During new employee orientation, Southwest Airlines flight attendants learn that recycling is part of routine cabin duties. Employees also receive recurring training through safety refresher courses at least once a year.

Delta Air Lines flight attendants are introduced to recycling policies and standards during new employee orientation through recycling literature, printed handouts on Delta procedures, and hands-on peer teaching.

A Training Partnership

Once a month, college interns provide one-on-one recycling training to tenants at Portland International Airport (PDX) on the airfield and in the terminal areas.

This partnership supports recycling at the airport and provides meaningful, skill-building experience for the students.



Step 2: Embed Recycling Expectations into Service Standards and Contracts



Airlines with successful recycling programs often have incorporated recycling responsibilities into flight attendant service standards and into contracts with cabin service contractors, contracted carriers, and flight kitchens. Doing this helps to sustain institutional commitment, even as individual champions and leaders change. It also provides motivation and structure for employees and contracted crews to share their knowledge and train fellow crew members in the procedures required for continued success of the program.

All of Alaska Airlines' flight kitchens are expected to recycle. Standard recycling requirements are included in flight kitchen agreements (see Appendix C for specific language).

Alaska Airlines has an in-flight service standard committee, composed of 12 flight attendants who meet twice each year to provide input and requests to flight kitchens. Some requests relate to sourcing recyclable materials as well as further collaboration for increasing recycling of waste materials generated in flight.

Step 3: Recognize and Reward Employees and Other Participants Who Contribute to Recycling

Some airline recycling programs were originally started by flight attendants who contributed proceeds from the sale of aluminum cans to emergency or recreational funds. Some airlines today donate a portion of recycling proceeds to charitable causes or give back to the employees who contribute to the program's success.

Many participants take their recycling efforts and leadership to the next level because they are motivated by the knowledge that they are contributing to a better world. Others prefer a little friendly competition. Leading airlines and airports are responding to these motivations with:

- Recycler of the month or year awards for frontline employees
 - A recycling fund for employee emergencies, charitable causes, or recognition events
 - Competitions between departments or crews for making the greatest progress in reducing waste, increasing recycling, or both
-

Delta Air Lines has used proceeds from in-flight aluminum can recycling to build two Habitat for Humanity homes, with more planned in the future.

Through regular waste assessments, Alaska Airlines' in-flight department can determine which flights have exemplary recycling results. Attendants on those flights receive gift cards as a reward for their contributions. Flight attendants are also invited to participate in the waste assessments, gaining special recognition within the company for their assistance.

In 2010, American Airlines recycled an estimated 15 million aluminum cans. Recycling revenue is directed to the company's Wings Foundation, an employee emergency fund that provides assistance to employees affected by natural disasters, illness or injuries, or other financial hardships.

Airports and airlines can also use these tools to recognize the contributions of partner organizations, such as flight kitchens and cabin service crews. For example, in 2010, Sea-Tac Airport initiated an annual “Green Gateway Environmental Excellence” award to recognize airport tenant environmental efforts, including recycling leadership.



Step 4: Share Results and Celebrate Achievements with Program Participants and the Public

Airlines, airports, and flight kitchens with successful recycling programs regularly share accomplishments and highlight areas needing improvement with key recycling participants within their organizations. This feedback can serve to inspire employees and contractors to sustain and improve on their recycling efforts.

Airlines, airports, and flight kitchens also share progress with the public through in-flight publications, annual reports, press releases, and other communications. These actions demonstrate corporate commitment to recycling and green business practices. They also provide the opportunity to generate positive media coverage and build goodwill among customers, investors, other stakeholders, and the public.

Some effective strategies for publicizing results include the following:

- Sharing visual depictions of the organization’s progress toward meeting recycling goals, such as graphs that present recycling rates or the percentage of total waste reduced
- Posting photos of successful recycling in action
- Highlighting stories of individuals who have made significant contributions to the organization’s recycling program
- Sharing an annual report on sustainability or corporate social responsibility that summarizes recycling achievements and progress toward goals.

Airlines, airports, and flight kitchens can gain recognition for their recycling achievements—from environmental leadership awards, to publicity in industry and mainstream media.

Airlines Gain Recognition for Achievements

In 2008, the U.S. Environmental Protection Agency awarded its WasteWise Gold Achievement Award to Delta Air Lines in recognition of the airline’s commitment to educating employees on the importance of recycling.



In 2010, the American Forest & Paper Association recognized Continental Airlines (now United) as an industry leader in paper recycling by awarding the airline its Business Leadership Recycling Award.

Regional Recognition

Alaska Airlines received the 2010 Green Gateway Environmental Excellence award from Sea-Tac International Airport, recognizing the airlines’ outstanding recycling efforts, among other environmental achievements.



In 2011, Alaska was awarded *Seattle Business Magazine*’s Green Business Award for leading the industry with its in-flight recycling efforts and reducing its carbon footprint.



Implementing Best Practices

Airlines, airports, and flight kitchens have an opportunity to turn today's best practices into standard business practices in the near future. In doing so, the air travel industry as a whole can capture millions of dollars of recycling revenues, benefit from reduced waste disposal costs, and reduce its environmental footprint. Working together, airlines, airports, and flight kitchens can maximize recycling and business benefits by

- **Fully utilizing and expanding on existing systems** for recycling at airlines, airports, and flight kitchens
- **Striving for greater consistency** in collection and handling practices for recyclables
- **Engaging key participants** in recycling efforts
- **Institutionalizing recycling** by creating and fostering a culture where recycling is the norm
- **Sharing best practices** within their organizations and across the industry at large

For additional information on implementing best practices, see the Best Practices Resources in Appendix C.

This guidebook is intended to share lessons learned from airlines, airports, and flight kitchens with successful recycling programs as well as to present practical steps for implementation and ideas for going further. Through partnerships with public agencies, the aviation industry can advance national efforts to recycle, prevent waste, and foster a culture of stewardship and sustainability.

Taking It to the Next Level

Airlines, airports, and flight kitchens with successful recycling programs are employing the best practices outlined in this guidebook and realizing associated business benefits. Real and complex challenges remain, however, to advancing recycling throughout the aviation industry. More research is needed to address key barriers, and strong collaboration among airlines, airports, and flight kitchens is vital for designing and advancing new strategies and approaches.

Organizations seeking to strengthen their own recycling and waste prevention efforts may consider adopting the innovative practices being developed by airlines, airports, and flight kitchens with successful recycling programs.

Foster Industry Learning through Further Research and Collaboration

Despite progress in recycling, there are still gaps hindering program adoption and expansion. Airlines, airports, and flight kitchens can partner to advance research and development. Key opportunities include the following:

- **Support and participate in periodic assessments** of waste collected from aircraft cabins to identify opportunities for additional recycling. Consider involving multiple parties in these assessments and share results throughout the aviation industry.
- Bring industry stakeholders together to **discuss challenges and opportunities for improving data collection and information sharing**, particularly on costs and quantities of recycling and waste disposal.
- **Study and share ideas and strategies for aligning price signals with program performance**, such as price or revenue per unit of material disposed of or recycled by individual airlines.
- **Create a system for classifying airports based on the recycling services offered** to airlines and other tenants (e.g., green/greener/greenest, comprehensive/basic/limited). Launch a communications campaign to inform affected parties, including flight attendants, cabin service companies, and other recycling participants.
- **Develop industry-specific metrics and design an industry-wide benchmarking tool or report card** for airlines, airports, and flight kitchens across the country to compare recycling rates, share best practices, and better connect recycling efforts.
- **Work with industry partners to address the opportunities and challenges of recycling on international flights.** Material collected from passenger aircraft making international flights is regulated by the U.S. Department of Agriculture (USDA) and subject to specific handling and disposal requirements that can pose challenges for in-flight recycling.¹⁵ Airlines, airports, and flight kitchens can work together with the USDA and other industry stakeholders to clarify concerns and identify opportunities for recycling from international flights.

Improve Program Performance through Innovative Best Practices

Airlines, airports, and flight kitchens seeking to **advance their own recycling and waste prevention efforts** may consider the following strategies for expanding recycling and composting, increasing efficiency, and preventing waste at its source:

- **Plan for recycling in airport or flight kitchen construction and aircraft design**, such as ensuring adequate and conveniently located space for storing recyclables on board aircraft.
- **Tap into passenger insights for maximizing recycling and reducing waste**, through online contests, in-flight surveys, social media, or other innovative strategies.
- **Expand programs to include options for composting organic materials**, such as coffee grounds, food scraps, food-soiled packaging, and biodegradable products. Collaborate with composting trade associations as well as waste and recycling service providers to explore new market opportunities for compostable materials.
- **Where adequate processing exists, consider implementing wet/dry collection systems** to separate valuable recyclables from compostable wet materials, like food scraps and liquid waste. Wet/dry processing options are currently available in selected regions, such as Northern California's Bay Area and Atlanta, Georgia.

Corporations and communities with aggressive waste reduction and recycling goals are spearheading some of these practices today. For example, Toyota North America has achieved its goal of sending no more than 5 percent of its waste to landfills over the past 3 years.¹⁶ Similarly, the City of San Jose, in California, adopted a *Zero Waste Strategic Plan* with a goal of 75 percent recycling by 2013 and zero waste by 2020.¹⁷ The city is working closely with its partners to expand new recycling, composting, and waste conversion opportunities to meet these ambitious goals.

Airlines, airports, and flight kitchens can benefit from the lessons learned, partnerships developed, and infrastructure created by these leaders in other sectors. The aviation industry can also play a leading role in accelerating our society's progress towards zero waste, creating greater business efficiencies, financial returns, and a healthier environment for all.



Endnotes

1. Disposal cost estimates were calculated based on FAA, "Passenger Boarding (Enplanement) and All-Cargo Data for U.S. Airports," www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger; A. Hershkowitz, D. Hoover, and P. Atkin, *Trash Landings: How Airlines and Airports Can Clean Up Their Recycling Programs*, Natural Resources Defense Council, New York, NY, December 2006; X.D. Li et al., "Waste Reduction and Recycling Strategies for the In-Flight Services in the Airline Industry," *Resources Conservation and Recycling*, May 2002; airport waste characterization studies; and interviews with industry experts.
2. The total quantity of recyclable material in the waste stream of U.S. passenger aircraft was estimated by applying average waste composition estimates (derived using data described in Endnote 5) to industry-wide waste disposal data (described in Endnote 1). The value of recyclable materials was estimated using market prices for recyclable commodities delivered to end users, from "Commodity Pricing," *Waste & Recycling News*, October 14, 2011.
3. Hershkowitz, Hoover, and Atkin, *Trash Landings; U.S. EPA, Developing and Implementing an Airport Recycling Program*, EPA-530-K-08-002. April 2009; and Office of Airports, Recycling, Reuse and Waste Reduction at Airports: A Synthesis Document, FAA, April 2013.
4. Disposal cost estimates were calculated based on FAA, "Passenger Boarding (Enplanement) and All-Cargo Data for U.S. Airports," www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger; A. Hershkowitz, D. Hoover, and P. Atkin, *Trash Landings: How Airlines and Airports Can Clean Up Their Recycling Programs*, Natural Resources Defense Council, New York, NY, December 2006; X.D. Li et al., "Waste Reduction and Recycling Strategies for the In-Flight Services in the Airline Industry," *Resources Conservation and Recycling*, May 2002; airport waste characterization studies; and interviews with industry experts.
5. The average composition of waste materials generated from passenger aircraft was estimated using data from waste composition studies of five flights from five different airlines that landed at PDX in 2011 and from 40 flights that landed at SEA in 2011. Composition data from PDX were obtained from PDX staff; the data are proprietary and have not been published. Composition data from SEA were collected by Cascadia Consulting Group and were delivered to Port of Seattle staff in the following unpublished report: "Seattle-Tacoma International Airport Airfield Waste and Recycling Characterization Study Report," Prepared by Cascadia Consulting Group, December 2011.
6. The total quantity of recyclable material in the waste stream of U.S. passenger aircraft was estimated by applying average waste composition estimates (derived using data described in Endnote 5) to industry-wide waste disposal data (described in Endnote 1). The value of recyclable materials was estimated using market prices for recyclable commodities delivered to end users, from "Commodity Pricing," *Waste & Recycling News*, October 14, 2011.
7. Market prices for recyclable commodities delivered to end users were derived from "Commodity Pricing," *Waste & Recycling News*, October 14, 2011.
8. Examples of recent media coverage include C. Negroni, "Leaving the Trash Behind," *New York Times*, February 22, 2010; H. Baskas, "For Airports and Airlines, Creative Recycling Brings Cost Savings," *USA Today*, May 12, 2010; D. Farley, "Airlines and Recycling: The Not-So-Green Skies," *Scientific American*, September 8, 2009. For examples of awards received by airlines, see: "Recognition for Recycling," Delta Air Lines Blog, November 21, 2008, <http://blog.delta.com/2008/11/21/recognition-for-recycling>; "2010 AF&PA Business Leadership Recycling Award Presented to Continental Airlines," American Forest & Paper Association News Release, April 22, 2010; "Alaska Airlines Named to Seattle Business Magazine 2011 Washington Green 50 list," Alaska Airlines Newsroom, accessed online on December 14, 2011, www.alaskaair.com/content/about-us/newsroom/alaska-awards.aspx; "Green Rankings 2012: U.S. Companies," *Newsweek*, www.thedailybeast.com/newsweek/2012/10/22/newsweek-green-rankings-2012-u-s-500-list.html; and Climate Counts, "Scorecard Sectors: Airlines," www.climatecounts.org/scorecard_sectors.php?id=26.

9. For more information about California's Mandatory Commercial Recycling Law, see Appendix C, or visit www.calrecycle.ca.gov/climate/Recycling/default.htm.
10. "Recycling Saves Energy," Pennsylvania Department of Environmental Protection, www.portal.state.pa.us/portal/server.pt/community/benefits_of_recycling/14061/save_energy/589519.
11. Cascadia Consulting Group, "Recycling and Economic Development," Prepared for King County (Washington) LinkUp Program, 2009; R.W. Beck, "U.S. Recycling Economic Information Study," Prepared for the Natural Recycling Coalition, 2001; G. Goldman and A. Ogishi, "The Economic Impact of Waste Disposal and Diversion in California," CalRecycle, 2001; Tellus Institute and Sound Resource Management, "More Jobs, Less Pollution: Growing the Recycling Economy in the U.S.," Prepared for the BlueGreen Alliance, 2011.
12. Cascadia Consulting Group, "Recycling and Economic Development," Prepared for King County (Washington) LinkUp Program, 2009; R.W. Beck, "U.S. Recycling Economic Information Study," Prepared for the Natural Recycling Coalition, 2001; G. Goldman and A. Ogishi, "The Economic Impact of Waste Disposal and Diversion in California," CalRecycle, 2001; Tellus Institute and Sound Resource Management, "More Jobs, Less Pollution: Growing the Recycling Economy in the U.S.," Prepared for the BlueGreen Alliance, 2011.
13. For information about recycling best practices for airports, see U.S. EPA, *Developing and Implementing an Airport Recycling Program* and FAA Office of Airports, *Recycling, Reuse and Waste Reduction at Airports: A Synthesis Document*.
14. As part of the supporting research for the development of this guidebook, a web-based survey was sent to staff contacts at 140 airports and 15 airlines. A total of 66 airports and 8 airlines completed the survey. The full list of respondents is included in the Author Acknowledgments section of this guidebook.
15. For more information, see the *Code of Federal Regulations*, Title 7, Section 330.400, pp. 415–418.
16. "Recycling and Resource Management," *2011 Toyota North America Environmental Report*, available online at www.toyota.com/about/environmentreport2011/03_recycling.html.
17. City of San Jose Environmental Services Department, *Zero Waste Strategic Plan*, 2008, available online at www.sjrecycles.org/zerowaste-stratplan.asp.



APPENDIX A

Definition of Terms

Roles and responsibilities for recycling and waste management vary across aviation sectors and by organization and facility. Below are definitions of common terms used in this guidebook.

Term	Definition or Role
Airline-managed waste and recycling system	An airline-managed system, in which either flight kitchen crews take materials to flight kitchens and in-house airline provisioning operations or cabin service crews place recyclables or waste materials in airline-owned or -operated containers.
Airport-managed waste and recycling system	An airport-managed system, in which cabin service crews or terminal maintenance personnel take recyclables or waste materials to airport-owned or -operated containers.
Cabin cleaners	See definition for <i>cabin service crews</i> .
Cabin service crews	These crews clean, stock, and remove waste from aircraft; they are typically based at the airport and are also referred to as <i>cabin cleaners</i> .
Capture rate	A measure that compares the amount of recyclables being recycled to the amount of recyclables that are either recycled or disposed of in the garbage. The capture rate is calculated as follows: total pounds of recyclables in recycling bins / (total pounds of recyclables in recycling bins + total pounds of recyclables in garbage containers).
Compostable	Materials accepted by a local composting service provider as compostable. Variations in commercial composting systems affect which products are accepted by each composting service provider. Commonly compostable items include food scraps, napkins, uncoated paper bags, uncoated paper cups and plates, floral arrangements, and yard trimmings. Items whose compostability status often varies by service provider include coated or lined paper dishware and plastics labeled as “compostable” or “biodegradable.”
Environmentally preferable purchasing	Choosing products that reduce harmful effects on the environment and human health. Green products may reduce the use of energy, water, nonrenewable materials, and toxic substances as well as reduce emissions and waste. They may be made from recycled or renewable materials, be recyclable, and/or be compostable.
Flight attendants	Workers whose primary role is to ensure passenger safety; flight attendants also provide food and beverage service, which includes handling recyclables and waste materials.
Flight kitchen crews	Workers who stock and remove materials from aircraft galleys, including food, beverages, cups, napkins, and waste materials. Flight kitchen services may include purchasing, stocking, and delivering galley carts to aircraft, as well as removing and emptying galley carts. Flight kitchens include both contracted catering operations and in-house airline provisioning activities, which may not necessarily involve food service or cooking.
Recyclable	Materials accepted by a local recycling service provider as recyclable. While recycling processes exist to convert many products into marketable commodities, a particular local recycling service provider may not accept all materials that could technically be recycled. Commonly recyclable products include aluminum and steel cans, plastic bottles (PET and HDPE), office paper, newspaper, magazines, glass bottles and jars, and scrap metal.

(continued on next page)

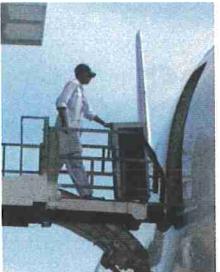
Term	Definition or Role
Recycled-content	The proportion of a product composed of recycled as opposed to virgin materials; for example, 30 percent recycled-content paper is manufactured using 30 percent recycled paper and 70 percent virgin material from cut trees.
Service items	These include durable and disposable cups, napkins, utensils, snack boxes and wrappers, and any other materials distributed to passengers during food and beverage service. Service items also include items used in service but not distributed to passengers, such as bulk juice or water containers as well as aluminum beverage cans.
Sustainability	Responsible management of resources, considering environmental, economic, and social factors.
Terminal maintenance crews and staff	These workers clean, maintain, and handle waste inside or outside airport terminals; terminal maintenance crews may be directly employed or contracted by airports.
Total cost accounting	A method of considering the total cost of a product, which includes more than the initial purchase price. Total costs include but are not limited to purchase, use and maintenance, transport and distribution, and disposal or recycling. Some products are also associated with costs or benefits that are difficult to monetize, such as customer disapproval or appreciation of environmentally preferable product attributes.
Waste and recycling haulers or service providers	These providers collect waste and recyclable materials, typically from dumpsters or compactors, for transport to disposal or recycling sites, such as landfills, transfer stations, material recovery facilities (MRFs), or recycling processors; they may also provide dumpsters or other collection containers to airport, airline, flight kitchen, or other customers.
Waste prevention	<p>Reducing the amount of solid waste (including recyclable materials) that is generated and subsequently collected for recovery or for final disposal. Waste prevention occurs upstream, before a material is produced or purchased, and is also known as source reduction. Common methods include the following:</p> <ol style="list-style-type: none"> 1. Purchasing less material-intensive products, such as beverage bottles that use less plastic (e.g., “lightweighting”). 2. Reducing the use of disposable products, such as encouraging passengers to take only the paper towels and napkins they really need. 3. Switching to more durable products, such as refillable water jugs, or non-product options, such as air-blower hand dryers instead of paper towels.

APPENDIX B

Recycling Best Practices Summary Sheets

Each of the four, two-sided Best Practices Summary Sheets included in Appendix B presents recycling best practices tailored for a particular audience—airlines, large and medium airport hubs, small-hub and non-hub airports, and flight kitchens.

Please note that PDFs of the recycling best practices summary sheets can be downloaded from www.trb.org/Main/Blurbs/169528.aspx.



ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

ADVANCING RECYCLING FROM AIRCRAFT CABINS

Strategies for Airlines

Commercial airlines in the United States deplane more than 200,000 tons of waste every year, mainly from in-flight food, beverages, and entertainment. Approximately 25 to 35 percent of this waste by weight consists of valuable recyclables such as aluminum cans, plastic bottles, and paper.

THE BUSINESS CASE—WHY RECYCLE?

According to industry estimates, the annual cost of disposing of aircraft waste is estimated at \$20 to \$26 million. Meanwhile, the market value of common recyclable materials generated from U.S. passenger flights is estimated at \$18 to \$26 million annually. While many airlines already recycle materials like aluminum, paper, or plastic bottles, significant opportunities still exist to reduce waste, increase recycling, and reduce provisioning costs. Effective recycling will also help meet new recycling requirements and build a positive green image.

BUILDING ON EXISTING SYSTEMS

Currently, deplaned waste and recyclables are typically directed to one of the following:

- An airport-managed system, in which cabin service crews or terminal maintenance personnel take materials to waste or recycling containers owned or operated by the airport or its contractor.
- An airline-managed system, in which either :
 - Flight kitchen crews take materials to flight kitchens or in-house airline provisioning operations for handling, or
 - Cabin service crews place materials in containers owned or operated by the airline or its contractor.

At airports where recycling infrastructure is not available or easily accessible to airlines, including some smaller airports, airlines may back-haul or transport recyclables to another location with the appropriate recycling services. The recycling best practices summarized here fully utilize and expand on the existing airport- and airline-managed systems for handling waste and recyclables. The parent document to this summary sheet, *ACRP Report 100: Recycling Best Practices—A Guidebook for Advancing Recycling from Aircraft Cabins*, provides more information.





Best Practices

for Recycling from Aircraft Cabins for Airlines

ACRPAIRPORT
COOPERATIVE
RESEARCH
PROGRAM

STRATEGIES FOR GETTING STARTED

In addition to partnering with airports on recycling, airlines can work with key recycling participants, such as flight attendants, in-house or contracted flight kitchens, and cabin service crews to implement the following **recycling best practices**.

Secure top-down and bottom-up commitment within the airline for recycling efforts. Successful recycling programs combine executive leadership and Green Teams with the active participation of frontline employees, from flight attendants to flight kitchen crews.

Develop consistent procedures to separate materials in flight. Recycling is most likely to succeed when recyclables are separated from garbage before landing.

Track, evaluate, and share data on program performance. Working with airports and flight kitchens to conduct periodic waste assessments and to track recycling rates, cost savings, and per-passenger waste quantities can increase recycling efficiency and uncover opportunities for program improvement.

Make recycling a part of everyday business by providing education, training, and support to flight attendants, flight kitchens, and cabin service crews—and celebrate success. Ongoing education and training improves program results, and sharing accomplishments demonstrates commitment to recycling and sustainable business practices.



Southwest Airlines has a companywide in-flight recycling program that recycled more than 2,500 tons and generated \$200,000 in recycling revenue in 2010.



Delta Air Lines publishes its recycling results regularly, and the U.S. EPA and Green America have publicly recognized the airline's recycling achievements.

OPTIONS FOR TAKING YOUR PROGRAM TO THE NEXT LEVEL

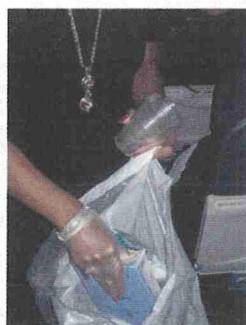
- Make purchasing choices that facilitate recycling and reduce waste.
- Look for opportunities to recycle additional materials that are periodically discarded from aircraft in large volumes, such as in-flight magazines.
- Extend recycling education and training opportunities to regional partner airlines.
- Offer incentives for flight attendants to reduce waste and maximize recycling.
- Address recycling in service agreements and job descriptions.
- Foster collaboration and support industry-wide recycling by sharing best practices with flight kitchens, airports, and other airlines.

RESOURCES

- ACRP Report 100: *Recycling Best Practices—A Guidebook for Advancing Recycling from Aircraft Cabins* (2014)
- Waste Assessment Resources in Appendix C of ACRP Report 100
- USEPA WasteWise program: www.epa.gov/epawaste/conserve/smm/wastewise



Alaska Airlines has conducted regular waste assessments of its in-flight materials since 2007. In 2011, the airline collected 49 percent of all recyclable material generated (by weight), according to assessment results.





TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

ADVANCING RECYCLING FROM AIRCRAFT CABINS

Strategies for Large & Medium Airport Hubs

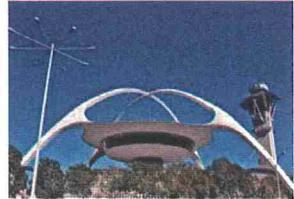
Large-hub and medium-hub airports account for about 90 percent of the country's 700 million annual passenger enplanements. These passengers generate more than 200,000 tons of waste onboard aircraft. Approximately 25 to 35 percent of this deplaned waste by weight consists of valuable recyclables such as aluminum cans, plastic bottles, and paper.

Significant opportunities are available at these airports for recycling materials from in-flight service. Even in regions with less robust recycling programs, stable markets usually exist for materials such as aluminum cans and newspaper, which can generate revenues from recycling.

THE BUSINESS CASE—WHY RECYCLE?

According to industry estimates, the annual cost of disposing of aircraft waste is estimated at \$20 to \$26 million. Meanwhile, the market value of common recyclable materials generated from U.S. passenger flights is estimated at \$18 to \$26 million annually. While many airports already recycle some materials like aluminum cans, paper, cardboard, or plastic bottles, significant opportunities remain to reduce waste and increase recycling of waste from passenger terminals, airport concessions, and deplaned from aircraft.

A well-designed and well-managed recycling program benefits both airports and airlines through improved economies of scale, reduced disposal costs, and increased passenger convenience and satisfaction. Effective recycling can also help meet state or local recycling requirements and build a positive green image. This summary focuses on recycling deplaned materials from in-flight food and beverage service. Airport-wide recycling is addressed elsewhere, such as the U.S. Environmental Protection Agency's guide, *Developing and Implementing an Airport Recycling Program*.



Los Angeles International Airport (LAX) provides recycling collection and support services in tenant and public areas throughout the airport.

The program collects a wide range of materials from cans, bottles, and paper, to scrap metal and pallets. Sales of recyclables generate approximately \$50,000 per year.

BUILDING ON EXISTING SYSTEMS

At airports across the United States, deplaned waste and recyclables from aircraft are typically directed either to

- An **airport-managed** system, in which cabin service crews or terminal maintenance personnel take materials to waste or recycling containers owned or operated by the airport or its contractor.
- An **airline-managed** system, in which either :
 - Flight kitchen crews take materials to flight kitchens or in-house airline provisioning operations for handling, or
 - Cabin service crews place materials in containers owned or operated by the airline or its contractor.

At airports where recycling infrastructure is not available or easily accessible to airlines, airlines may back-haul or transport recyclables to another location with the appropriate recycling services. The recycling best practices summarized here fully utilize and expand on the existing airport- and airline-managed systems for handling waste and recyclables. The parent document to this summary sheet, *ACRP Report 100: Recycling Best Practices—A Guidebook for Advancing Recycling from Aircraft Cabins*, provides more information.

Separate summary sheets are available for small-hub and non-hub airports, airlines, and flight kitchens.



Best Practices

for Recycling from Aircraft Cabins at Large & Medium Airport Hubs

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

STRATEGIES FOR GETTING STARTED

In partnership with airlines and their contractors as well as other key recycling participants, airports can implement the following **recycling best practices**.

Secure top-down and bottom-up commitment within the airport for recycling efforts. Leading programs combine executive leadership and Green Teams with the active support of frontline employees.

Develop consistent recycling procedures and infrastructure. Standardizing the recycling procedures and collection infrastructure to accommodate both materials from the airport terminal and deplaned waste will support recycling and efficiency. Provide clearly marked recycling containers paired with all waste containers, and share clear recycling procedures and site maps with airlines, flight kitchens, and other tenants.

Track, evaluate, and share data on program performance. Tracking airline-specific recycling rates, waste quantities, and cost savings from recycling supports continuous improvement in recycling. Airports can request reports from their waste haulers on quantities and costs of waste and recycling services and share the results with airlines.

Make recycling part of everyday business by providing education, training, and support to airport personnel, concessionaires, airlines, and others—and celebrate success.



At Portland International Airport (PDX), college interns provide monthly one-on-one recycling training to tenants in the airfield and terminal areas. This partnership supports recycling at the airport and provides meaningful work experience for the students.



Seattle-Tacoma International Airport (SEA) charges airline tenants customized rates for waste disposal, using data estimated based on compactor usage. Airlines and other tenants use key cards to open waste and recycling dumpsters on the airfield. The airport provides each airline its recycling rate, garbage fee, and savings from recycling.



San Francisco International Airport (SFO) designed its new terminal with zero waste in mind. The airport embedded 16 sustainable policies in its concessions contracts, including requiring all disposables to be compostable or recyclable. The successful new food court has no garbage containers—only recycling and composting bins.

OPTIONS FOR TAKING YOUR PROGRAM TO THE NEXT LEVEL

- Conduct periodic waste assessments to identify additional recycling opportunities.
- Make purchasing choices that facilitate recycling and reduce waste. Airports can also encourage terminal vendors to sell recyclable items and minimize packaging waste.
- Separate waste disposal and recycling costs in tenant lease agreements, so that airlines and other tenants have a direct financial incentive to reduce waste and increase recycling.
- Where possible, use large compacting collection dumpsters to maximize collection efficiencies and cost savings.
- Foster collaboration and support industry-wide recycling by sharing best practices and lessons learned with other airports, airlines, and flight kitchens as well as industry trade associations.

RESOURCES

- ACRP Report 100: *Recycling Best Practices—A Guidebook for Advancing Recycling from Aircraft Cabins* (2014)
- USEPA's *Developing and Implementing an Airport Recycling Program* (2009)
- FAA's *Recycling, Reuse and Waste Reduction at Airports: A Synthesis Document* (2013)





ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

ADVANCING RECYCLING FROM AIRCRAFT CABINS

Strategies for Small-Hub & Non-Hub Airports

More than 300 small-hub and non-hub airports in the United States handle more than 80 million passenger enplanements annually. These passengers generate an estimated 20,000 tons of waste onboard aircraft. Approximately 25 to 35 percent of deplaned waste by weight consists of valuable recyclables such as aluminum cans, plastic bottles, and paper.

Smaller airports often serve smaller aircraft with shorter flights, and they are less likely to have full catering operations. At these airports, airlines typically dispose of their waste in airport-managed containers, rather than developing their own airline-managed system for waste handling.

Significant opportunities are available at these airports for recycling materials from in-flight service. Even in regions with less robust recycling programs, stable markets usually exist for materials such as aluminum cans and newspaper, which can generate revenues from recycling.

THE BUSINESS CASE—WHY RECYCLE?

Disposing of aircraft waste at small airports costs millions of dollars annually. Meanwhile, valuable recyclables are thrown away as garbage. While some small-hub and non-hub airports already recycle, opportunities remain to increase recycling of waste from passenger terminals and deplaned from aircraft. A well-designed and well-managed recycling program benefits airports and airlines through improved economies of scale, reduced disposal costs, and increased passenger satisfaction. Effective recycling can also help meet state or local recycling requirements and build a positive green image. This summary sheet and the associated document, *ACRP Report 100: Recycling Best Practices—A Guidebook for Advancing Recycling from Aircraft Cabins*, focus on recycling deplaned materials. Airport-wide recycling is addressed elsewhere, such as the U.S. Environmental Protection Agency's guide, *Developing and Implementing an Airport Recycling Program*.

BUILDING ON EXISTING SYSTEMS

At airports across the United States, deplaned waste and recyclables from aircraft are typically directed either to

- An **airport-managed system**, in which cabin service crews or terminal maintenance personnel—or flight attendants, on smaller aircraft—take materials to waste or recycling containers owned or operated by the airport or its contractor. At small hubs and non-hubs, this arrangement is more common than airlines having their own separate waste systems.
- An **airline-managed system**, in which either :
 - Flight kitchen crews take materials to flight kitchens or in-house airline provisioning operations for handling, or
 - Cabin service crews place materials in containers owned or operated by the airline or its contractor.

At airports where recycling infrastructure is not available or easily accessible to airlines, including some smaller airports, airlines may back-haul or transport recyclables to another location with the appropriate recycling services. The recycling best practices summarized here fully utilize and expand on the existing airport- and airline-managed systems for handling waste and recyclables. The parent document to this summary sheet, *ACRP Report 100: Recycling Best Practices—A Guidebook for Advancing Recycling from Aircraft Cabins*, provides more information.

Separate summary sheets are available for large-hub and medium-hub airports, airlines, and flight kitchens.



Best Practices

for Recycling from Aircraft Cabins at Small-Hub & Non-Hub Airports

ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

STRATEGIES FOR GETTING STARTED

Communication and teamwork form the basis for effective recycling. Airports can work with airline station managers to understand specific airline recycling needs and to develop and promote recycling procedures. Building on this partnership, smaller airports can implement the following **best practices** to develop effective recycling programs.



Secure top-down and bottom-up commitment within the airport for recycling efforts.

Leading airport recycling programs combine executive leadership with the active support of frontline employees. At a smaller airport, only a few staff and managers may be directly involved in the waste system, so obtaining their support and participation is key to success.

Develop consistent recycling procedures and infrastructure. Waste haulers often offer recycling, as do recycling companies and nonprofit organizations teaching job skills. Work with your recycling hauler and program participants to develop clear recycling procedures that support success. Providing clearly marked recycling containers paired with all waste containers is a key part of a consistent, effective recycling system throughout the airport.

Akron-Canton Airport (CAK) worked with the Stark-Tuscarawas-Wayne Joint Solid Waste Management District to provide recycling infrastructure and collection services at the airport for no additional charge. All airlines are encouraged to use the system.

Increase the efficiency of existing systems. Right-sizing waste dumpsters and collection schedule can create space for a dedicated recycling container. Switching to compacting waste containers can be an easy way to save on disposal costs immediately.



Track, evaluate, and share data on program performance. Tracking airline-specific recycling rates, waste quantities, and cost savings can improve and demonstrate recycling benefits. Airports can request reports from their waste haulers on quantities and costs of waste and recycling services and share results with airlines to support participation.

The passenger terminal at Lafayette Airport (LFT) recycles aluminum cans, plastic bottles, and paper through a local non-profit's job training program. To expand beyond public area recycling, the airport sent a letter to all airlines and other tenants inviting them to participate.

Make recycling part of everyday business by providing education, training, and support to airport personnel, concessionaires, and others—and celebrate success. Smaller airports can hold in-person meetings with airline station managers and extend invitations to attend airport training sessions to support recycling. Providing ongoing education and training can improve program results, while sharing program achievements can demonstrate commitment to recycling and sustainable business practices.

OPTIONS FOR TAKING YOUR PROGRAM TO THE NEXT LEVEL

- Conduct periodic waste assessments to identify recycling opportunities.
- Separate waste disposal and recycling costs in tenant lease agreements, so that airlines and other tenants have a direct financial incentive to reduce waste and increase recycling.
- Foster collaboration and support industry-wide recycling by sharing best practices and lessons learned with other airports and regional airlines.

RESOURCES

- ACRP Report 100: *Recycling Best Practices—A Guidebook for Advancing Recycling from Aircraft Cabins* (2014)
- USEPA's *Developing and Implementing an Airport Recycling Program* (2009)
- FAA's *Recycling, Reuse and Waste Reduction at Airports: A Synthesis Document* (2013)



Some airports use college interns to provide one-on-one recycling training to tenants. These partnerships support recycling at the airport and provide meaningful work experience for the students, at little cost to the airport.



ACRP

AIRPORT
COOPERATIVE
RESEARCH
PROGRAM

TRANSPORTATION RESEARCH BOARD
OF THE NATIONAL ACADEMIES

ADVANCING RECYCLING FROM AIRCRAFT CABINS

Strategies for Flight Kitchens

Commercial airlines in the United States deplane more than 200,000 tons of waste every year, largely from the provisioning of in-flight food and beverages. Approximately 25 to 35 percent of this waste by weight consists of valuable recyclables such as aluminum cans, plastic bottles, and paper. Flight kitchens—defined broadly to include all flight catering operations, including in-house airline provisioners, that supply flights with food, beverages, snacks, and associated service items—are a major collector of this deplaned waste after it reaches the destination airport.



THE BUSINESS CASE—WHY RECYCLE?

Flight kitchens play an important role in the recycling system as they both provide the food, beverages, and service items for the airlines and receive deplaned waste through galley carts. According to industry estimates, the annual cost of disposing of aircraft waste is estimated at \$20 to \$26 million. Meanwhile, the market value of common recyclable materials generated from U.S. passenger flights is estimated at \$18 to \$26 million annually. While some flight kitchens already recycle materials like aluminum, plastic bottles, or paper, significant opportunities still exist to reduce waste, increase recycling, and reduce provisioning costs. Effective recycling can help flight kitchens save money and provide better service. Recycling can also help meet state or local recycling requirements and build a positive green image.

BUILDING ON EXISTING SYSTEMS

Currently, deplaned waste and recyclables are typically directed to one of the following :

- An **airport-managed** system, in which cabin service crews or terminal maintenance personnel take materials to waste or recycling containers owned or operated by the airport or its contractor.
- An **airline-managed** system, in which either :
 - Flight kitchen crews take materials to flight kitchens or in-house airline provisioning operations for handling, or
 - Cabin service crews place materials in containers owned or operated by the airline or its contractor.

At airports where recycling infrastructure is not available or easily accessible to airlines, including some smaller airports, airlines may back-haul or transport recyclables to another location with the appropriate recycling services. The recycling best practices summarized here fully utilize and expand on the existing airport- and airline-managed systems for handling waste and recyclables. The parent document to this summary sheet, *ACRP Report 100: Recycling Best Practices—A Guidebook for Advancing Recycling from Aircraft Cabins*, provides more information.

Alaska Airlines handles its catering and recycling through six flight kitchen locations. Flights are often double-catered at the origin airport, meaning that food service is provided for both the outbound and return trips. Recyclable materials from both flights are typically returned to the original catering location for recycling, while bagged garbage is often unloaded at each airport.



Best Practices

for Recycling from Aircraft Cabins for Flight Kitchens

ACRPAIRPORT
COOPERATIVE
RESEARCH
PROGRAM

STRATEGIES FOR GETTING STARTED

Flight kitchens can partner with airlines and in-house airline provisioning can work with in-flight and facilities departments to implement the following **recycling best practices**.

Secure top-down and bottom-up commitment within the flight kitchen and its airline customers for recycling efforts. Successful recycling programs combine executive leadership and Green Teams with active support of frontline employees, including crews that collect and handle materials from the aircraft galley. Flight kitchens can work with airlines to identify and support opportunities for recycling and minimizing waste.

Develop consistent procedures to handle recyclables from galley carts. Consistent in-flight separation and storage of recyclables in galley carts facilitates recycling at the flight kitchen. Providing convenient, clearly marked recycling containers next to each waste container in the flight kitchen increases recycling and reduces contamination.

Track, evaluate, and share data on program performance. Working with airline customers to conduct periodic waste assessments and to track recycling rates, cost savings, and per-passenger waste quantities can increase recycling efficiency and uncover opportunities for improvement.

Make recycling part of everyday business by providing education, training, and support on recycling handling and storage to kitchen and airline personnel—and celebrate success. In the kitchen, on the truck, and in the galley, providing specific information and visual cues on recycling collection, storage, and handling supports effective recycling.



Gate Gourmet's LAX flight kitchen handles aluminum cans for recycling on behalf of its airline clients. The company earns recycling revenue and shares the proceeds with multiple airlines.



One airline reported having over 35 different galley arrangements due to aircraft types and international flights. Streamlining galley setups will foster efficiency and make it easier for flight attendants and flight kitchens to recycle.

OPTIONS FOR TAKING YOUR PROGRAM TO THE NEXT LEVEL

- Make or recommend purchasing choices that facilitate recycling and reduce waste.
- Work with airlines to develop contracts that deliver cost savings for increased recycling and reduced waste. Making the costs of waste and recycling visible and sharing the benefits of recycling with airline customers can foster greater participation.
- Consider collecting food scraps and other organics for composting, where possible.
- Foster collaboration and support industry-wide recycling by sharing best practices and lessons learned across locations within your company and with other airline customers.

RESOURCES

- ACRP Report 100: *Recycling Best Practices—A Guidebook for Advancing Recycling from Aircraft Cabins* (2014)
- Sample environmental policy from LSG Sky Chefs:
www.lsgskychefs.com/fileadmin/lsgskychefs/downloads/other/lsgsc_enviro_policy.pdf
- Alaska Airlines Food Service Policies & Procedures in Appendix C of *ACRP Report 100*



Alaska Airlines and Virgin America share dumpsters to recycle aluminum cans, paper, and plastics at six flight kitchen locations that serve both airlines.





APPENDIX C

Best Practices Resources

The following pages contain resources intended to provide more information on the topics covered in this guidebook, including the following:

- Resources compiled from the airports, airlines, and flight kitchens that have participated in this research project
- Links to selected mandatory commercial recycling requirements for reference
- Information on procuring recyclable and compostable products

Sample Airline Recycling Program Web Pages

Many airlines provide information on their waste reduction and recycling efforts and achievements through their websites. Examples are listed below:

- Alaska Airlines (www.alaskaair.com/content/about-us/social-responsibility/recycling-and-waste-reduction.aspx)
- American Airlines (www.aa.com/i18n/aboutUs/corporateResponsibility/environment/material-use.jsp)
- Delta Air Lines (www.delta.com/content/www/en_US/about-delta/corporate-responsibility/environmental-sustainability.html)
- Southwest Airlines (www.southwest.com/html/southwest-difference/southwest-citizenship/environmental-initiatives/index.html)
- United Airlines (www.united.com/web/format/pdf/globalcitizenship/23413_Flyer_Environmental_Sustainability_Web_FINAL.PDF)
- Virgin America (www.virginamerica.com/about/environmental-sustainability.html)

General Resources on Sustainability in the Commercial Aviation Industry

Table C-1 shows examples of resources for airlines, airports, and flight kitchens interested in improving the sustainability of their operations.

Sample Industry Conference Presentations

The airport and airline presentations listed in Table C-2 share additional best practices and resources to improve recycling and general environmental efforts by the U.S. commercial aviation industry.

Table C-1. Examples of resources on sustainability in the aviation industry.

Resource	Responsible Organization	URL
Sustainable Aviation Resource Guide and Sustainability Database	Sustainable Aviation Guidance Alliance	http://airportsustainability.org/sites/default/files/SAG A%20Final2.pdf http://airportsustainability.org/database
Sustainable Airports Manual	Chicago Department of Aviation and the Sustainable Airports Manual Committee	http://airportsgoinggreen.com/SAM
Airports Going Green (AGG) Annual Conference	Chicago Department of Aviation and the AGG Steering Committee	http://airportsgoinggreen.com/

Sample Service Standard and Contract Language

Alaska Airlines Food Service Policies & Procedures

Alaska Airlines provides the *Food Service Policies & Procedures* document shown in Figure C-1 to flight attendants and flight kitchen contractors to facilitate consistent procedures that maximize recycling.

SFO Sustainable Food Guidelines

San Francisco International Airport asks that all tenants using its zero-waste terminal (Terminal 2) adhere to the food guidelines shown in Figure C-2, intended to reduce waste and promote environmental, social, and economic sustainability.

Table C-2. Airport and airline presentations on recycling and environmental efforts.

Author	Affiliation	Presentation	URL
Toby Enqvist	Vice President of Environmental and Security, United Airlines	“Commitment to Environmental Responsibility” Sustainable Airline Initiatives Panel, Airports Going Green Conference, November 10, 2010	www.airportsgoinggreen.com/Content/Documents/Toby%20Enqvist.pdf
Intissar Durham	Chief Airports Engineer, Los Angeles World Airports	“Sustainability and Recycling at Los Angeles World Airports” Recycling Initiatives Panel, Airports Going Green Conference, August 6, 2009	www.airportsgoinggreen.com/Content/Documents/LAWA%20Sustainability%20and%20Recycling_Durham.pdf
Sam Mehta	San Francisco International Airport	“SFO Recycling” Recycling Initiatives Panel, Airports Going Green Conference, August 6, 2009	www.airportsgoinggreen.com/Content/Documents/Recycling_Mehta.pdf
Phil Ralston	General Manager of Aviation Environmental and Safety, Portland International Airport	“PDX Waste Management” Recycling Initiatives Panel, Airports Going Green Conference, August 6, 2009	www.airportsgoinggreen.com/Content/Documents/PDX%20Waste%20Management_Ralston.pdf
Paul Manasjan	Director of Environmental Affairs, San Diego County Regional Airport Authority	“Managing Sustainability through Metrics” Recycling Initiatives Panel, Airports Going Green Conference, August 6, 2009	www.airportsgoinggreen.com/Content/Documents/Managing%20Sustainability%20Through%20Metrics_Manasjan.pdf



FOOD SERVICE POLICIES & PROCEDURES

Section: 1.000
Page: 41
Date: 10/1/11

Alaska Airlines Recycling Procedures

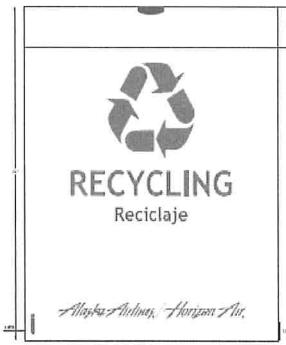
◆ = changes

A. Alaska Airlines currently recycles the following items from flights.

- 1) Aluminum Cans (empty soda, beer, etc)
- 2) Plastic (#1 PETE which includes empty plastic water bottles, plastic ASA beverage cups, etc)
- 3) Glass (empty beer and wine bottles)
- 4) Paper and Cardboard (Juice boxes, newspaper, picnic pack boxes)
- 5) ◆ Recycleable Hot Cups.

B. Other Onboard Waste may be able to be collected and recycled at the kitchens if the local recycling plant can handle the commodity. One example is the Alaska Airlines Juice boxes.

C. **RECYCLE BAG:** These items are collected onboard by Flight Attendants and placed into a clear pickup bag. Part # AS1006 20x24 ASA Logo Clear 1.5 mil recycle bag. See section 2.100 for packing quantities of recycling bag in First Class and Main Cabin.



D. Expectation from Catering Vendors is to recover this recycling content in the clear recycle bags and follow one of three options.

- 1) Place it into recycle bins for pickup by Alaska Airlines approved vendor.
- 2) Take recycling to local airport recycling bins.
- 3) Leave the recycling in carts for return to HUB Airports. (SEA, PDX, ANC, SFO, SJC , LAX)

Those kitchens not able to meet the expectations of one of the three options above must receive authorization from Alaska Airlines to deviate from this process.

E. Onboard Food and Beverage team members will monitor this recycling procedure during annual or quarterly audits.

Figure C-1. Alaska Airlines food services contract.

SFO is committed to providing a dining experience that is healthy for passengers, employees and the environment. Tenants are required to provide good, clean and fair food which has been responsibly sourced and deliciously prepared. The following must be adhered to throughout the term of the lease. This guideline may be amended by the Airport from time to time.

Tenants must feature:

1. Displays that promote healthful eating and good environmental stewardship
2. Visible food preparation areas
3. Portion sizes which support good health
4. Portion-appropriate menu items for children

Tenants must use:

1. Low- or non-phosphate detergents
2. Compostable, bio-resin bottles or paper boxes for all bottled water sales
3. Unbleached paper products and compostable To Go containers and utensils

To the very greatest extent possible, Tenants must use:

1. Organic agricultural products from the Northern California region
2. Agricultural products that have not been genetically modified
3. Organic or all-natural meat from animals treated humanely and without hormones or antibiotics
4. rBST-free cheese, milk, yogurt and butter
5. Cage-free, antibiotic-free eggs
6. Sustainable seafood
7. Fairly Traded Organic Coffee
8. Products free of hydrogenated oils
9. Products free of artificial colors, flavors and additives

Figure C-2. San Francisco International Airport food guidelines for tenants.

Sample Educational Materials

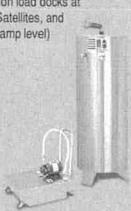
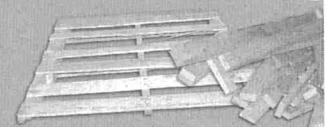
Sea-Tac International Airport provides all tenants with a recycling guide that outlines the airport's recycling programs and goals. The brochure includes waste and recycling containers for tenant use as shown in Figure C-3. (To view the full brochure, please visit <http://www.portseattle.org/Environmental/Materials-Management/Recycling/Documents/SEA%20Recycling%20Brochure%202010.pdf>.) Figure C-4 shows airport recycling signage at Sea-Tac.

Waste Assessment Resources

General Instructions for Conducting a Visual Waste Assessment

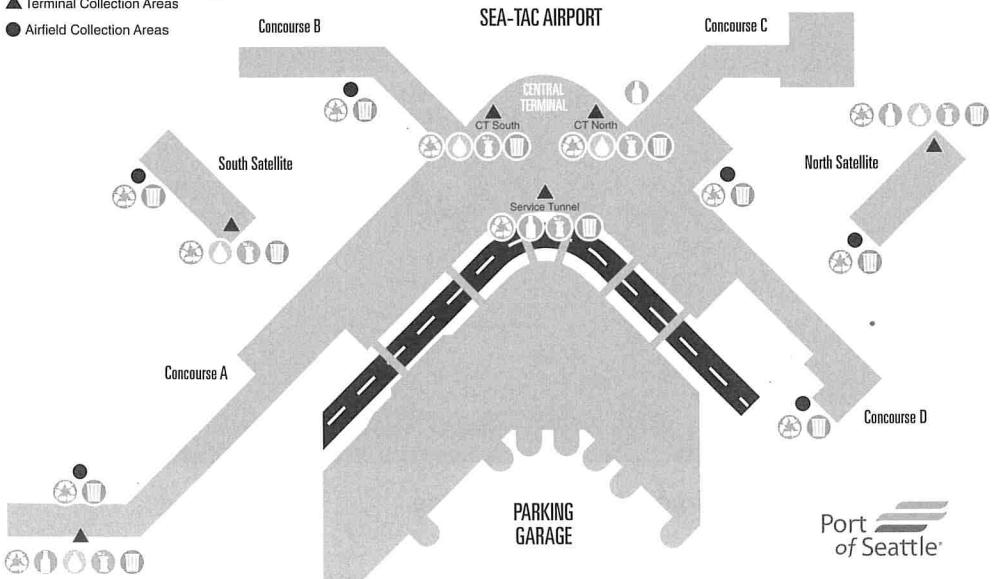
Cascadia Consulting Group provided the instructions shown in Figure C-5 to facilitate effective and efficient assessments of the types of materials disposed of or recycled by airlines, airports, or flight kitchens.

The form shown in Figure C-6 is for documenting the amounts or percentages of specific materials included in a waste assessment.

<h1>WHAT TO RECYCLE AND WHERE</h1>	<p>CO-MINGLED RECYCLING (For key to unlock compactor, call 206-787-6838.)</p> <p>Cardboard (flattened, no wax); magazines, newspapers, mixed office paper & shredded paper (bagged); plastic jars, jugs, bottles & tubs (bagged); plastic bags & shrink wrap (bagged); and aluminum & tin cans (bagged)</p> <p>TERMINAL: Blue compactors on load docks at Concourse A, North & South Satellites and in service tunnel; and in Central Terminal trash rooms (ramp level)</p> <p>AIRFIELD: Blue compactors on ramp at gates A10, B4, C1, D11, N6 and S16</p>  	<p>GLASS</p> <p>Glass bottles (wine, beer, liquor & soft drink) and glass jars</p> <p>TERMINAL: Dumpsters on load docks at Concourse A, in service tunnel, and on ramp at Gates C2 and N11</p> <p>AIRFIELD: Concourse A load dock and on ramp at Gates C2 and N11</p>  
<p>USED COOKING OIL</p> <p>Waste cooking oil is converted to bio-diesel.</p> <p>TERMINAL: Oil collection tanks on load docks at Concourse A and North & South Satellites, and in Central Terminal trash rooms (ramp level)</p>  	<p>FOOD SCRAPS</p> <p>Food soiled paper, napkins, used coffee grounds, compostable bags & service ware and other organic material These items are sent to a local facility and processed into compost for gardens and landscaping.</p> <p>TERMINAL: Compost collection bins on load docks at Concourse A, North & South Satellites & in service tunnel; and in Central Terminal trash rooms (ramp level)</p> <p>AIRFIELD: Compost collection bins on ramp at Gate C2</p>  	<p>TRASH (For key to unlock compactor, call 206-787-6838.)</p> <p>Non-recyclable material such as styrofoam, coffee cups, plastic utensils & food wrappers</p> <p>TERMINAL: Tan compactors on load docks at Concourse A, North & South Satellites and in service tunnel; and in Central Terminal trash rooms (ramp level)</p> <p>AIRFIELD: Tan compactors on ramp at Gates A10, B4, C1, D11, N6 and S16</p>  
<p>WOOD (Scrap)</p> <p>Pallets and untreated or non-painted dimensional lumber</p> <p>AIRFIELD: Port Airfield Maintenance Shop at Air Cargo 4 and Air Cargo 2 at blast fence</p> 	<p>SCRAP METAL</p> <p>Steel, rebar, aluminum, wire or other metal items that contain a limited amount of non-metallic materials (such as a metal chair with cloth cushion)</p> <p>TERMINAL: Green dumpster on service tunnel load dock</p> <p>AIRFIELD: Air Cargo 2 & 4 and north snow dump area</p> 	<p>FOOD DONATION PROGRAM</p> <p>Unsold, pre-packaged food that would otherwise be thrown away can be donated to local food banks. For information, call 206-787-5525.</p> <p>RECHARGEABLE BATTERY RECYCLING FLUORESCENT LIGHT BULB RECYCLING</p> <p>For information, call 206-787-5525.</p> <p>ELECTRONICS & HAZARDOUS WASTE</p> <p>For information on recycling computers, monitors, laptops & televisions, visit E-Cycle Washington at www.ecyclewashington.org. For proper disposal of hazardous waste, check the regulations posted at www.ecy.wa.gov/programs/hwtr/business.html.</p>

SEA-TAC RECYCLING MAP

▲ Terminal Collection Areas
● Airfield Collection Areas



Printed with soy-based ink on recycled paper manufactured using wind-generated electricity.

Figure C-3. Sea-Tac Airport guide to recycling—"What to Recycle and Where."



Figure C-4. Sea-Tac Airport recycling signage.

BEFORE YOU START

1 Plan

- Determine waste assessment goals.
- Decide on materials to include (e.g., all waste collected in flight by attendants).
- Identify number of samples needed based on goals and desired level of accuracy.
- Plan schedule to capture representative waste samples.
- Determine materials to observe and/or sort.
- Assign responsibilities for capturing and assessing waste.
- Determine whether to engage third party to assist.

2 Prepare

- Coordinate with appropriate partners to set aside materials for assessment.
- Gather the following supplies:

- | | |
|---|---|
| • Pencils/pens | • Camera |
| • One medium to large tarp | • Tape measure |
| • Gloves: a combination of latex or nitrile gloves and ordinary garden gloves provide good protection | • Forms for recording assessment information (see examples below) |
| • Box cutter(s) | • Scales (if approach involves hand-sorting and weighing) |

CONDUCTING THE ASSESSMENT

3 Set out waste

- Place the selected waste on the open tarp.

4 Measure volume of waste

- Record the average length, width, and height of the pile, in inches.

5 Note days of collection period

- Note the number of days over which the waste was collected. Knowing the average time required to generate a certain volume of waste allows you to extrapolate waste generation amounts for a longer time period.

6 Open the bags

- Use the box cutter to split open the bags of waste and place waste on tarp.

7 Photograph the waste

- Take multiple photographs of the waste, including, if any, materials of particular note (e.g., significant numbers of aluminum cans or large amounts of newspaper).

8 Note all materials present

- Make a note of every material you see in the waste.
- Note what material type each material is (e.g., paper, plastic, metal, organic, hazardous waste, other/“unknown”).

9 Estimate or weigh the amount of each material

- If you have a scale, weigh each material and record the weight.
- If you are conducting a visual assessment, begin with the most commonly present material and visually estimate its percentage by volume.

AFTER THE ASSESSMENT

10 Analyze assessment results

- Compile waste assessment results.
- Analyze information to meet waste assessment goals (such as current recycling levels and amount of waste that could be recycled through existing programs).
- Perform a quality check to minimize data errors.
- Summarize results into easy-to-understand graphs or tables.

11 Report results to key participants and program partners

- Send waste assessment results to those involved in the assessment.
- Report results to recycling participants (employees, contractors).
- Share results, lessons learned, and best practices to others in industry.

Figure C-5. Instructions for waste assessment.

* Contact your local solid waste department about disposal.

Figure C-6. Example waste audit form.

Onboard Waste Assessment Guidance: Alaska Airlines

The document shown in Figure C-7 describes Alaska Airlines' procedures for conducting regular waste assessments to determine how much material is being recycled from flights.

Mandatory Recycling Commercial Recycling Regulation Examples

Several states, cities, and counties require businesses and commercial entities—including airports, airlines, and flight kitchens—to recycle. This section provides references and links to a selection of commercial recycling regulations. Examples are presented in Table C-3 of regulatory text from the states of California, Connecticut, New Jersey, and Rhode Island.

State of California – Mandatory Commercial Recycling Regulation

On and after July 1, 2012, a business that generates more than four cubic yards of commercial solid waste per week or is a multifamily residential dwelling of five units or more shall arrange for recycling services, consistent with state or local laws or requirements, including a local ordinance or agreement, applicable to the collection, handling, or recycling of solid waste, to the extent that these services are offered and reasonably available from a local service provider.

A commercial waste generator shall take at least one of the following actions:
(1) Source separate recyclable materials from solid waste and subscribe to a basic level of recycling service that includes collection, self-hauling, or other arrangements for the pickup of the recyclable materials; (2) Subscribe to a recycling service that may include mixed waste processing that yields diversion results comparable to source separation.

Examples are presented in Table C-4 of regulatory text from various U.S. cities.

Selecting Recyclable and Compostable Products

Products accepted for recycling and composting vary by municipality and by waste and recycling service provider. It is important to check with your local recycling collection company about the products they will accept and, for food service products, what level of food contamination is allowed. While some recycling collection companies accept a little food on recyclable products, such as plastic food containers that have been rinsed, others will reject any recyclable contaminated with food.

After consulting your local recycler about requirements for recyclable and compostable products in your area, check with your current supplier. Many suppliers already offer options for the most common food service product categories that may be recyclable or compostable in your area. It is a good idea to confirm with your local recycler that the products you have selected will be accepted for recycling or composting.

Although no nationwide, comprehensive list exists, you can find examples of products in lists compiled by jurisdictions that mandate the use of recyclable and compostable products and by looking for compostable product standards. However, remember that your local recycler may not accept all products on these sample lists and may accept products not listed. Some sample product listings are provided in Table C-5.



How to Arrange an Onboard Waste Assessment

Why do a waste assessment? We collect Metrics (data) for recycling to determine how much waste is being recycled off our Aircraft.

1. **Arrange with Catering Kitchen/ Local Airport.**
 - a. Does Catering kitchen facility or local airport have space available, time and personnel available to assist with sort?
2. Decide on Date of Sort and publish only date of actual sort, not tagging date. (set dates for entire year if possible)
3. **Get team together from Airline:** Email all volunteers with kitchen location, timing, and type of shoes to wear. Keep track of volunteers on a server so one person doesn't have all the information. Keep track of volunteers and ask for 2 to 4 hour commitments.
 - a. Flight Attendant Group (email management, green team, past volunteers)
 - b. Onboard Food and Beverage
 - c. Local catering facility kitchen
 - d. Local Airport. (Environmental Department) (Port Badges or Visitor Badges needed?)
 - e. Local Fleet Service or Cabin Cleaning.
 - f. Local Station (green team members and CSA group?)
 - g. Green Team newsletter asking for volunteers.
4. **Tagging flights on the field** - Go on field and tag flights the evening prior, also make sure that kitchen separates and keeps the flights from being washed/ cleaned prior to sort. Write down catering truck number if tagging day of sort if possible. Pull recycling night prior from inbound flights. (Also cabin waste - coordinate with cabin cleaning/ fleet service department). See "Tagging flights on the field" below.
 - a. Need rolls of colorful Duct tape and sharpies to adhere FLT # to carts and bags of trash from Aircraft bins.
 - b. Ask Kitchen to segregate all food & beverage carts, garbage and cabin waste in the dish room area.
 - c. After tagging flights, call dispatch at catering kitchen with flight numbers.
 - d. **Supplies to bring on the Field (Tarmac)**
 1. INBOUND/ OUTBOUND Sheet to keep track of flights. (This is an Alaska Air program)
 2. Yellow Safety Vests for on the field. (2 or 3)
 3. Several Clipboards and pen (s) and Sharpies
 4. Duct Tape (colorful for tagging flights)
 5. Light Plastic Gloves for bagging trash if needed.
 6. Snacks, water and hand sanitizer (Caterer may provide)
 7. Flashlight if needed.
5. **Supplies to bring for sort (day of):**
 - a. Camera with extra batteries. (Extra camera is helpful) (No pictures at Catering facilities of items other than waste assessment without permission)
 - b. Scale to weigh. (we use Ohaus model SD35)
 - c. Data sheets (AS and QX). (bring extra) on clipboard with pens
 - d. Heavy Plastic Gloves (Some volunteers may prefer a heavier glove than provided by caterer)
 - e. Large Clear Plastic containers for sorting (Walmart clear plastic containers used) with Tare weight written on container.
6. **Catering Kitchen provided:**
 - a. Stainless table or two to set containers on (kitchen provided- saves the back!).
 - b. Large Recycle Can (on wheels) with clear liners
 - c. Large Garbage Can (on wheels) with buff or black liner.
 - d. Tyvek Jackets for all volunteers
 - e. Plastic Aprons for all volunteers
 - f. Light Plastic Gloves for all volunteers
7. **How to sort:** Keeping each flight separate, go through each cart, garbage bag and recycling bag to determine our recycling rate. It is easiest to sort garbage bags first from each flight (buff bags, grey bags) holding aside any clear recycle bags or blue drawer of cans. Keep the procedure standard for the whole sort to eliminate confusion. Items that Flight attendants intend to recycle are kept aside to sort after the



garbage. Items like drawers of empty aluminum cans, loose plastic bottles and newspapers are items which should be included in recycling totals as flight attendants intend those items to be recycled at the catering kitchen.

8. These are the items included in Alaska Airlines recycling program: (see picture below)

- a. GLASS (beer and wine bottles - all color)
- b. PLASTIC (Liquor mini's, water bottles, wine PET bottles, platters, plastic hot and cold cups)
- c. ALUMINUM (could be in bags, or blue drawers - either is intended to be recycled)
- d. PAPER, JUICE BOXES, CARDBOARD PICNIC PACK BOXES, NEWSPAPER, Magazines or Inflight Paperwork.



9. **Setup person (or team)** - Remove all glassware, unused soda, oven racks or equipment that is not included in sort. This team can also move the recycling and carts to sort area for Sort Team and should make sure all carts are "together" so that all carts and bags are sorted at one time.
10. **Sort Teams** - Minimum of 2 people to sort each flight. Need good coordination to keep track of what has been weighed and sorted. *Sort just one flight at a time.*
11. Provide clear directions for volunteers on what is gathered and what is not: cabin waste, galley waste, cart wastes, lav waste, etc. and where it is obtained from (off plane, from fleet service, from caterer at kitchen, etc.)
12. How it will be separated, i.e. categories: #2 plastic, aluminum, paper, glass, non-recyclable, etc. See Inflight Waste Assessment worksheet below with separate categories used by Alaska Airlines.
13. Directions on how-to. I.e. divide wastes by type (or is it waste location - recycle bags? Cabin waste bags? Drink trays) and place into a bin. Tare the weight on the scale... etc.
14. Currently, our procedure is to measure everything else as GARBAGE. Put Garbage into a large container, lined with a BUFF bag for easy disposal if possible. This includes Food waste like coffee grounds, all opened and used napkins.
15. Drain all liquids into containers, or down the drain as we are not currently measuring the liquid. This includes juice, ice, soda, water.



16. Re-weigh each container after tossing recycling or garbage into kitchen provided cans.
17. Call out to the person with clipboard by the scale the weight, and what you are weighing.
18. Sample waste assessment chart:

Inflight Waste Assessment Worksheet

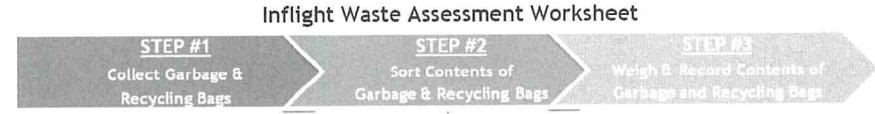
Prepared By (First, Last): _____ Flight Number: _____

Date of Assessment (MM-DD-YYYY): _____

Route (E.g. ANC-SEA; or ANC-JNU-SIT-KTN): _____ Total Passengers*: _____

Material in Garbage Bags					Material in Recycling Bags				
Waste	Bin #	F or G?	WEIGHT	TARE	TOTAL	F or G?	WEIGHT	TARE	TOTAL
Non-Recoverable Materials	#1		-	-	=		-	-	=
	#2		-	-	=		-	-	=
	#3		-	-	=		-	-	=
	#4		-	-	=		-	-	=
Aluminum	#1		-	-	=		-	-	=
	#2		-	-	=		-	-	=
	#3		-	-	=		-	-	=
	#1		-	-	=		-	-	=
Paper	#2		-	-	=		-	-	=
	#1		-	-	=		-	-	=
	#2		-	-	=		-	-	=
	#1		-	-	=		-	-	=
Plastic	#2		-	-	=		-	-	=
	#3		-	-	=		-	-	=
	#4		-	-	=		-	-	=
	#1		-	-	=		-	-	=
Glass	#2		-	-	=		-	-	=
Comments:									

*To calculate total passengers add (+) the total passenger seats occupied during each leg of the route. Example: route ANC-JIU-SIT-KTH = ANC (67 occupied seats) + JIU (70 occupied seats) + SIT (65 occupied seats) + KTH (70 occupied seats) = 272 Total Passengers



Step #1 - What to Collect:

- 1(a) Collect all garbage and recycling bags from the flight deck, galley and fleet services.
- 1(b) Garbage bags are typically solid in color, while recycling bags are either clear or green.
- 1(c) Confirm the contents of each bag with the crew and fleet services before tagging and removing from the aircraft.

Step #2 - How to Sort:

- 2(a) Separate bags into two groups: 1) Garbage bags; and 2) Recycling bags.
- 2(b) Clearly label 6 individual bins using the following categories: 1) Non-Recoverable Materials, 2) Aluminum, 3) Paper, 4) Plastic, 5) Glass, and 6) Liquids.
- 2(c) Sort the contents of each bag into the appropriately labeled bin.
- 2(d) Drain all liquids from waste materials into the liquids bin before they are weighed.
- 2(e) The chart below shows examples of what materials belong under each of these categories.

Step #3 - How to Weigh & Record Data:

- 3(a) Fill each individually labeled bin with the identified waste. Once filled, weigh and record a total.
- 3(b) For each individually labeled bin, record a TARE weight - i.e. the weight of an empty bin by itself.
- 3(c) If an individually labeled bin is filled and weighed multiple times, please add these weights and record a total.
- 3(d) Subtract each individually labeled bin's TARE weight from its total weight and record the total.

Waste Assessment Material Chart			
Non-Recoverable Materials	<ul style="list-style-type: none"> - Food & Fiber Scraps - Liquids (Coffee, Water, Soda, Ice, etc.) - Plastic wrap - Non-Alaska Airlines Coffee cups 	<ul style="list-style-type: none"> - Containers with Food Wastes - Soiled Materials - Used napkins 	
Aluminum	<ul style="list-style-type: none"> - Aluminum Cans (Soda, Beer, and Juice Cans) 		
Paper	<ul style="list-style-type: none"> - Starbucks Hot Cups (Coffee & Tea Cups) - Aseptic Containers (Juice Boxes) - Newspapers & Magazines 	<ul style="list-style-type: none"> - Office Paper - Paper Packaging - Corrugated Cardboard 	
Plastic	<ul style="list-style-type: none"> - Plastic Drink Cups - Plastic Bottles (e.g. Water, Soda, & Mini-Alcohol Bottles) 	<ul style="list-style-type: none"> - Plastic Containers Marked with #1 or #2 - Plastic Platters (Tops & Bottoms) 	
Glass	<ul style="list-style-type: none"> - Glass Bottles 	<ul style="list-style-type: none"> - Glass Jars 	



b. Other things to note:

1. Day or two before the sort: Check scale to make sure it works.
2. Generally, ASA Waste sorts can take 4 or 5 hours depending on number of people and flights sorted.
3. Figure out ahead of time what our strategy is for our waste sort (any change in methodology?)
4. Make a photocopy of the raw data as soon as you get back to the office and also enter and do the report as soon as possible. This will eliminate the headache of losing the data and having to do the sort over.
5. Take pictures of items sorted - and also of a piece of paper with flight number so data doesn't get confused. Also take fun pictures of volunteers.
6. Enter Data into worksheet on a server.
7. Arrange Travel arrangements/ hotels for trips in locations other than Seattle prior to sort
8. Non-Disclosure agreement for non- Alaska personnel. (No press unless invited).



Table C-3. Examples of recycling regulatory text.

California	Chapter 476, Statutes of 2011 [Chesbro, AB 341], Section 42649.2 <ul style="list-style-type: none"> • www.leginfo.ca.gov/pub/11-12/bill/asm/ab_0301-0350/ab_341_bill_2011006_chaptered.html • www.calrecycle.ca.gov/climate/Recycling/default.htm
Connecticut	Chapter 446d: Solid Waste Management <ul style="list-style-type: none"> • www.cga.ct.gov/current/pub/chap446d.htm Annotated list of statutes <ul style="list-style-type: none"> • www.ct.gov/dep/cwp/view.asp?a=2714&q=324888&depNav_GID=1645
New Jersey	Title 7. Environmental Protection / Chapter 26a. Recycling Rules / Subchapter 10. Standards for Generators of Source Separated Recyclable Materials <ul style="list-style-type: none"> • www.state.nj.us/dep/dshw/resource/2009%20RULES/26A%20RECYCLING.pdf • www.nj.gov/dep/dshw/recycling/recy_act_link.htm
Rhode Island	Regulation # 12-070-003 <ul style="list-style-type: none"> • www.dem.ri.gov/pubs/regs/regs/stratpol/commrecy.pdf

Table C-4. Regulatory text from various U.S. cities.

Chicago, IL	<ul style="list-style-type: none"> • www.cityofchicago.org/content/city/en/depts/streets/supp_info/recycling1/commercial_retailrecycling.html
Honolulu, HI	Chapter 9 Collection and Disposal of Refuse /Article 3: Regulations Applicable to Businesses, Private Dwellings and Government Facilities / Section 9-3.1 Business <ul style="list-style-type: none"> • www1.honolulu.gov/council/ocs/roh/rohchapter9.pdf • www.opala.org/solid_waste/archive/Mandatory_Recycling_Laws.html
Minneapolis, MN	Title 9: Fire and Police Protection /Article IV: Commercial Building Registration Requirements / Ordinance 174.435 <ul style="list-style-type: none"> • http://library.municode.com/index.aspx?clientId=11490&stateId=23&stateName=minnesota • www.minneapolismn.gov/regservices/fire/WCMS1P-082517
New York, NY	Title 16, Chapter 3, Subchapter 2, Section 16-306: Private Carter-collected Waste <ul style="list-style-type: none"> • www.nyc.gov/html/nycwasteless/downloads/pdf/laws/recycling_adcode.pdf • www.nyc.gov/html/nycwasteless/html/laws/local_commmrecycling.shtml
Philadelphia, PA	City Ordinance Section 10-717 and 10-724 <ul style="list-style-type: none"> • https://secure.phila.gov/streets/commrecycling/
Pittsburgh, PA	Title Six: Conduct /Article I – Regulated Rights and Actions / Chapter 619: Refuse Collection and Recycling <ul style="list-style-type: none"> • www.city.pittsburgh.pa.us/pw/assets/05_Ordinances_Chapter_619_entire.pdf • www.city.pittsburgh.pa.us/pw/html/commercial_recycling.html
Portland, OR	Chapter 17.102.270: Solid Waste & Recycling Collection: Businesses and Multifamily Complexes Required to Recycle <ul style="list-style-type: none"> • www.portlandonline.com/bps/index.cfm?f=41472&a=373194 • www.portlandonline.com/bps/index.cfm?f=47899&
San Francisco, CA	Ordinance 100-09 <ul style="list-style-type: none"> • www.sfeenvironment.org/downloads/library/sf_mandatory_recycling_composting_ordinance.pdf
Seattle, WA	SMC 21.36.082 Commercial recycling required <ul style="list-style-type: none"> • http://clerk.ci.seattle.wa.us/~public/code1.htm • www.seattle.gov/util/groups/public/@spu/@csb/documents/webcontent/cons_003964.pdf

Table C-5. Sample product listings.

ASTM International Standard Specifications for Compostable Products	ASTM D6400 is a standard specification for compostable plastics <ul style="list-style-type: none"> • www.astm.org/Standards/D6400.htm ASTM D6868 is a standard specification for the biodegradability of plastic-coated paper products <ul style="list-style-type: none"> • www.astm.org/Standards/D6868.htm
Products Certified by the Biodegradable Products Institute (BPI)	<ul style="list-style-type: none"> • www.bpiworld.org
U.S. EPA Environmentally Preferable Purchasing Resources	<ul style="list-style-type: none"> • www.epa.gov/epp/index.htm
California Sustainability Initiative, Local Government Green Procurement Guide	<ul style="list-style-type: none"> • http://sustainca.org/sites/default/files/publications/Local_Government_Green_Procurement_Guide.pdf
Michigan Department of Environmental Quality, The Green Industry Guide to Environmental Purchasing	<ul style="list-style-type: none"> • http://mtesp.org/assets/Modules/11GreenPurchaseingGuide2006.pdf
Stopwaste.org (Alameda County), Guidelines for Buying Environmentally Preferable Products	<ul style="list-style-type: none"> • http://stopwaste.org/docs/guidelinesforepproducts.pdf
Products Accepted for Recycling and Composting by the City of San Francisco	<p>Definitions of recyclable and compostable</p> <ul style="list-style-type: none"> • www.sfeenvironment.org/downloads/library/accepted_product_list_8.2011.pdf <p>Vendor list:</p> <ul style="list-style-type: none"> • www.sfeenvironment.org/downloads/library/fsw_vendor_list_7.2011.pdf
Products Accepted for Composting by Cedar Grove Composting (Washington State)	<ul style="list-style-type: none"> • www.cedar-grove.com/acceptable/Accepted%20List.asp

APPENDIX D

Supporting Research

To collect information on recycling from aircraft cabins, the ACRP Project 02-15 research team conducted web-based surveys of both airports and airlines and completed site visits to 11 airports (6 primary research sites and 5 additional sites visited during airline and flight kitchen research), 6 airlines, and 2 major flight kitchen companies at multiple airport locations. The web-based survey received responses from 66 airports, ranging from large hubs to non-hubs, and from 8 airlines (7 major and 1 regional). Table D-1 presents airport survey respondents by airport size and region. Figure D-1 shows a map of airport survey respondents and sites visited, and Table D-2 lists the sites visited for field research.

Based on this field research, the following findings are noteworthy among airports:

- Currently, recycling programs for deplaned waste do not cover the full range of recyclable materials and are often implemented inconsistently.
- The main reported barriers to recycling include the following challenges:
 - Lack of consistency in recycling availability and implementation.
 - Insufficient communication, education, and knowledge about recycling procedures and opportunities.
 - Cost barriers and insufficient incentives to recycle.
 - Lack of leadership, management support, or organization-wide goals.
 - Constraints regarding sorting or storing materials for recycling at airports of all sizes.
- Consistent in-flight separation of recyclables by flight attendants is central to successful recycling.
- Flight kitchens (including other types of provisioning stations) and airports receive deplaned waste, and many of these locations already recycle some materials.
- Because small airports do not typically have airline recycling programs or flight kitchens, they are usually responsible for managing the majority of materials, and thus they present a particular opportunity to increase recycling.

As shown in Figure D-2, more than 80 percent of airports surveyed offer recycling in their facilities for aluminum cans, mixed paper, plastic bottles, and cardboard. More than half offer recycling for aluminum cans and mixed paper deplaned from aircraft. Recycling is less commonly available for materials like plastic cups or aseptic containers (e.g., juice boxes), whether these materials come from aircraft, terminals, or elsewhere at the airport.

Figure D-3 shows airports that recycle, compost, or both as well as which materials are included in their programs. The table provides information according to airport size—large, medium, small, and non-hub—and where materials are generated (from aircraft or in terminals). Note that Figure D-3 shows whether recycling *is available*, not whether it actually occurs.

Table D-1. Airport survey respondents.

	West	Central	East	Total by type
Large Hub	7	4	7	18
Medium Hub	5	5	9	19
Small Hub	3	12	7	22
Non-Hub	--	2	5	7
Total By Region	15	23	28	66

The following challenges keep airports and airlines from recycling a larger portion of deplaned materials from domestic flights, according to survey responses and field research:

- Lack of consistency in recycling availability and implementation of recycling procedures in flight and on the ground
- Disconnect between airports and airlines and generally insufficient communication or education among all parties
- Constraints regarding sorting or storing materials for recycling, in flight and at airports of all sizes
- Costs or insufficient incentives to recycle
- Lack of leadership, management support, or company-wide goals
- Insufficient employee time or interest
- Limited local recycling markets or service providers for materials

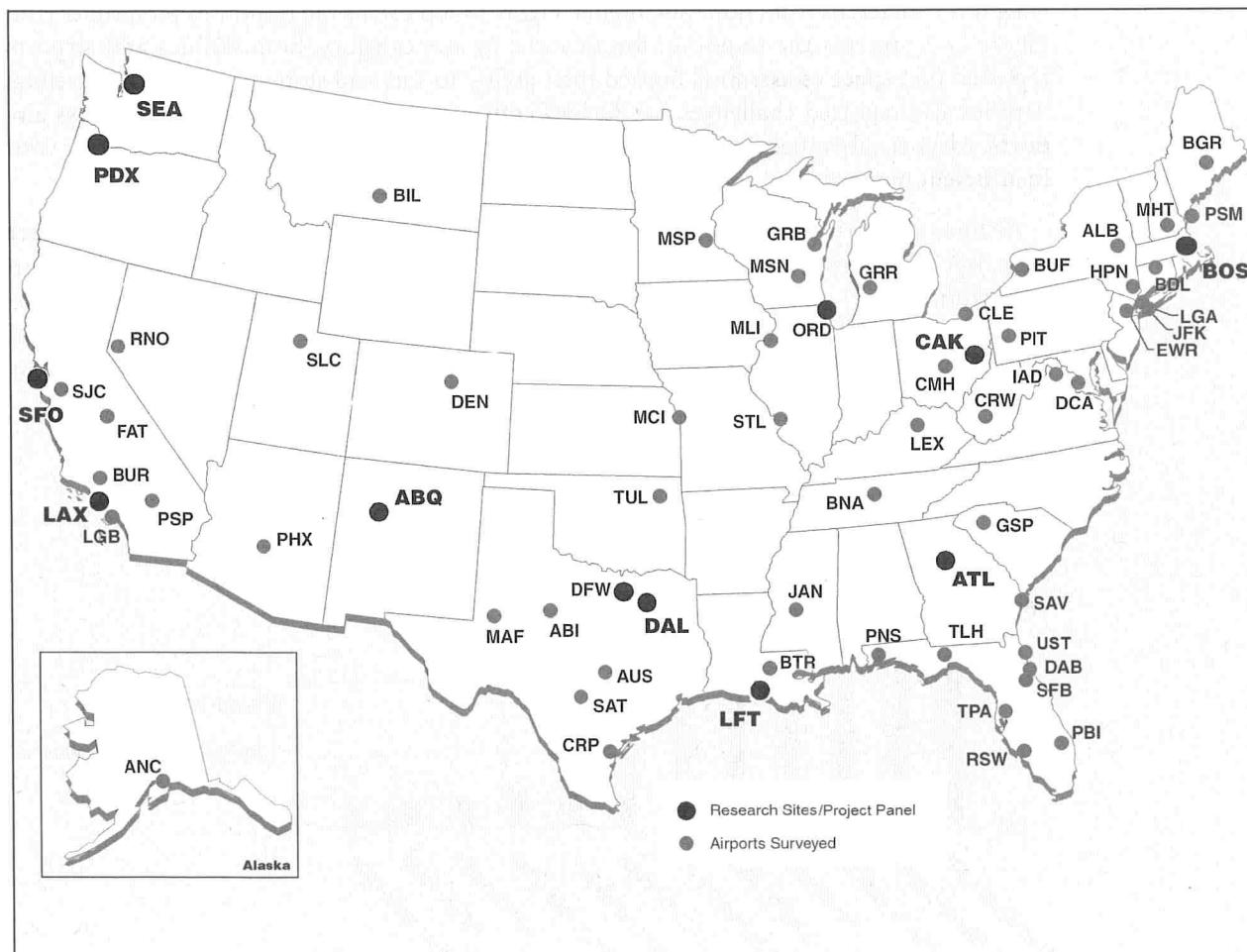
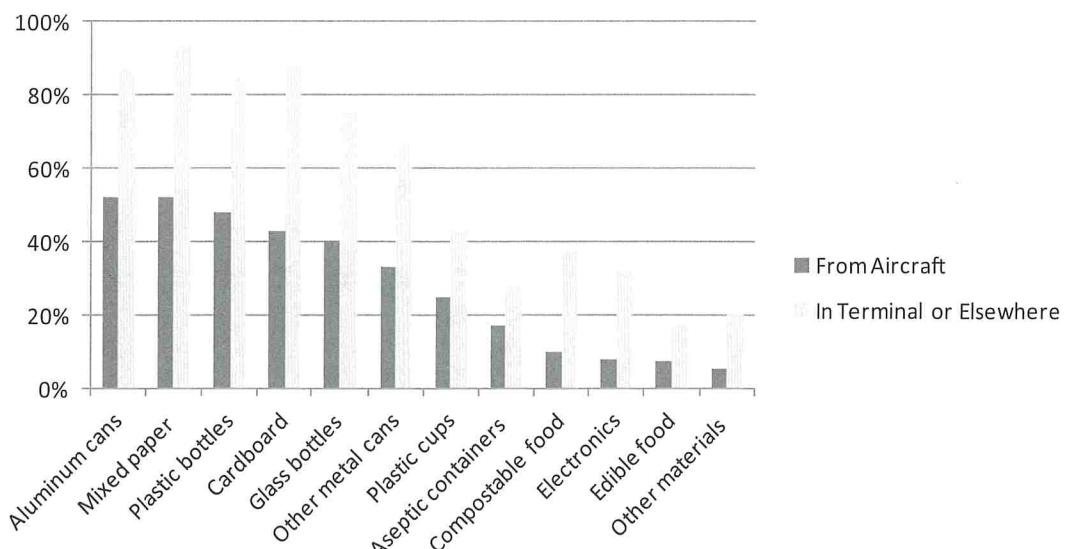
**Figure D-1. Map of airports that participated in surveys and field research.**

Table D-2. Sites visited during field research.

Sites	Dates
Albuquerque International Sunport (ABQ)	March 24–25, 2011
Akron-Canton (CAK)	April 25–26, 2011
Chicago O'Hare International Airport (ORD)	April 27–29, 2011
Dallas Love Field (DAL)	April 18–20, 2011
Dallas-Fort Worth International Airport (DFW)	April 20, 2011
Hartsfield-Jackson Atlanta International Airport (ATL)	April 4–7, 2011
Lafayette Regional Airport (LFT)	May 11, 2011
Los Angeles International Airport (LAX/LAWA)	April 5–7, May 3, 2011
Portland International Airport (PDX)	June 13, 2011
San Francisco International Airport (SFO)	May 10, 2011
Seattle-Tacoma International Airport (SEA)	May 11–12, 2011 and other visits
Delta Air Lines	April 7, 2011 (also during airport visits)
Alaska Airlines (including Horizon Air)	May 11–12, May 16, June 13, 2011 (also during airport visits)
American Airlines	April 19–20, 2011 (also during airport visits)
Southwest Airlines (including in-house provisioning)	April 18–20, 2011 (also during airport visits)
United Airlines (and Continental, formerly)	April 27–29, 2011 (also during airport visits)
Virgin America	May 10, 2011 (also during airport visits)
LSG Sky Chefs (LAX, PDX, SEA)	April 5, May 12, June 13, 2011 (also during airport visits)
Gate Gourmet (LAX)	May 3, 2011 (also observed during airport visits)

Airlines and airports were asked to select the top three challenges that kept them from recycling more materials from domestic flights. Figure D-4 presents the responses for airlines, and Figure D-5 presents the responses for airports, by size category. Both airlines and airports reported that **space constraints** limited their ability to sort and store materials for recycling. Airlines also reported challenges due **lack of consistency in recycling programs across airports**. Airports identified a **lack of employee time and interest** as a top challenge, along with **insufficient management support**, and **recycling cost concerns**.

Airlines and airports also were asked to select the top changes that would make it easier to recycle more materials, by quantity and type, from domestic flights. The most common opportunity that airlines identified was **improved recycling programs at airports**, followed by **financial assistance or economic incentives** and **single-stream recycling**. Figure D-6 summarizes the responses from airlines. For airports, the top opportunity across large,

**Figure D-2.** Recycling collection availability at airports (as reported in surveys).

Materials	Large hub (18 resp.)	Medium hub (19 resp.)	Small hub (22 resp.)	Non-hubs (7 resp.)	Overall (66 respondents)
Recycled from Terminals					
Plastic bottles	15	83%	17	89%	12
Plastic or foam cups	6	33%	8	42%	7
Glass bottles	13	72%	15	79%	10
Aluminum cans	14	78%	17	89%	13
Other metal cans	10	56%	11	58%	9
Cardboard	11	61%	16	84%	12
Mixed paper	15	83%	17	89%	14
Aseptic containers	5	28%	4	21%	5
Edible food	2	11%	2	11%	0
Food scraps	4	22%	5	26%	1
Electronic equipment	4	22%	3	16%	2
Other materials	1	6%	2	11%	0
Recycled from Aircraft					
Plastic bottles	8	44%	13	68%	8
Plastic or foam cups	5	28%	6	32%	4
Glass bottles	7	39%	10	53%	8
Aluminum cans	10	56%	11	58%	10
Other metal cans	7	39%	8	42%	5
Cardboard	8	44%	11	58%	7
Mixed paper	9	50%	11	58%	10
Aseptic containers	4	22%	3	16%	2
Edible food	2	11%	2	11%	0
Food scraps	4	22%	2	11%	1
Electronic equipment	3	17%	1	5%	1
Other materials	1	6%	1	5%	0

Figure D-3. Reported availability of recycling by airport size.

Challenges Reported by Airlines	Airlines	Airlines (8 respondents)
1. Constraints regarding sorting or storing materials for recycling (such as lack of space)	6	75%
2. Lack of consistency in recycling programs across airports	6	75%
3. Poor airport recycling programs	2	25%
4. Security or regulatory issues	2	25%
5. Cost of recycling	1	13%
6. Lack of corporate or management support	1	13%
7. Lack of employee time or interest	1	13%
8. Poor communication between airlines and airports	1	13%
9. Other (see below):	3	38%
<p><i>Airlines being unable to account for their waste or recycling as there are combined containers used by carriers at most airports.</i></p> <p><i>Logistics of getting recyclables off aircraft and to the recycling facility in a manner that will not drive extra cost or cause delays in the operations.</i></p> <p><i>Would like to include glass (wine bottles) in our acceptable recyclable items, but because of our structure and quick turnaround situations, provisioning agents are often forced to handle the bags in a rough manner. As a result, glass is a safety issue and we do not include it in our program.</i></p> <p><i>Sorting constraints are one barrier because safety is our flight attendants' first focus, not trash handling. Also, other materials are generated less on board (e.g., glass) and would not be cost-effective to recycle due to limited amounts of the product. Cannot recycle on inbound international flights due to USDA regulations, unfortunately; much goes to waste here.</i></p> <p><i>Airport or kitchen's lack of ability to accept commingled recycling. No city infrastructure that support recycling pick-ups.</i></p>		The most common challenges that airlines reported were Constraints regarding sorting or storing materials for recycling and Lack of consistency in recycling programs across airports .

Figure D-4. Challenges to increased recycling reported by airlines in survey.

Challenges Reported by Airports	Large hubs (16 resp.)	Medium hubs (18 resp.)	Small hubs (20 resp.)	Non-hubs (6 resp.)	Overall (60 respondents)
1. Sorting/storage space constraints	11 69%	6 33%	11 55%	3 50%	31
2. Lack of employee interest or time	3 19%	9 50%	7 35%	4 67%	23
3. Lack of corporate or management support	4 25%	8 44%	5 25%	3 50%	20
4. Cost of recycling	3 19%	8 44%	5 25%	3 50%	19
5. Disconnect between airlines and airport	6 38%	4 22%	6 30%	2 33%	18
6. Lack of local recycling markets or service providers	0 0%	4 22%	8 40%	2 33%	14
7. Contamination issues from tenants or passengers	4 25%	2 11%	5 25%	0 0%	11
8. Lack of employee training	2 13%	4 22%	2 10%	0 0%	8
9. Lack of information on recycling options/benefits	1 6%	2 11%	0 0%	1 17%	4
10. Security or regulatory issues	1 6%	0 0%	2 10%	0 0%	3
11. Other (see below):	7 44%	1 6%	3 15%	0 0%	11

It's up to the airline to sort and recycle. They have to set goals within the constraints of airport bases and the availability of recycling at each. Lack of awareness on part of passengers. Lack of staff to implement and maintain recycling program. Because waste disposal is included in overall airline/airport contracts, it is difficult to economically incentivize participation. For in-flight recycling to succeed, the airport needs to have the infrastructure in place. Contractual arrangements. Limited airside space for recycle dumpsters and access to same. Multiple contractual arrangements with little agency control. Short turnaround times on domestic flights. Airline staff are reluctant to take on the additional work of having to sort aircraft waste. Biggest challenge is creating a culture to recycle. That will not happen until an efficient program is offered that streamlines labor and time. Liquid contamination. The MRF is challenged in separating wet materials.

The number one challenge across large and small hub airports involved **Space constraints limiting the ability to sort and store recycled materials**. Non-hub airports also ranked this among their top three challenges.

Medium-hub and non-hub airports identified a **Lack of employee time and interest** as the top challenge, followed closely by a **Lack of top-down support** and **Cost of recycling**.

Figure D-5. Challenges to increased recycling reported by airports in survey.

Opportunities Reported by Airlines	Airlines	Airlines (7 respondents)
1. Improved recycling programs at airports	6 86%	
2. Financial assistance or economic incentives	4 57%	
3. Single-stream recycling	4 57%	
4. Aviation industry association involvement	2 29%	
5. Recycling requirements	2 29%	
6. Regulatory changes (other than recycling requirements)	2 29%	
7. Information and technical assistance	1 14%	
8. Other (see below):	2 29%	

We have implemented a very successful onboard recycling program that captures a good amount of recyclables, for which our national waste and recycling partner provides thorough reporting and rebates.

We have created a program where the top five items generated on-board aircraft are recycled. Other materials are not part of the program because they are either contaminated with food (e.g., plastic clam shells) and thus unattractive to vendors, or there is so little of a material generated on board that it financially does not warrant recycling (e.g., glass wine bottles -- we don't generate enough to recycle them).

The most common opportunity that airlines reported was **Improved recycling programs at airports**, followed by **Financial assistance or economic incentives** and **Single-stream recycling**.

Figure D-6. Opportunities reported by airlines in survey.

Opportunities Reported by Airports	Large hubs (16 resp.)	Medium hubs (18 resp.)	Small hubs (20 resp.)	Non-hubs (6 resp.)	Overall (60 respondents)
1. Improved recycling programs across airlines	16 100%	13 72%	16 80%	3 50%	48
2. Aviation industry association involvement	9 56%	3 17%	6 30%	1 17%	19
3. Financial assistance or economic incentives	5 31%	6 33%	6 30%	1 17%	18
4. Recycling requirements	4 25%	7 39%	4 20%	1 17%	16
5. Encouragement from stakeholders	4 25%	4 22%	3 15%	4 67%	15
6. Improved access to recycling markets	0 0%	5 28%	8 40%	2 33%	15
7. Information and technical assistance	2 13%	4 22%	4 20%	0 0%	10
8. Information to help "make the case"	0 0%	4 22%	4 20%	1 17%	9
9. Other (see below):	2 13%	1 6%	1 5%	0 0%	4
<p>Ability to provide access to the containers, and a willingness by airlines/tenants to properly use them. Modified contractual arrangements providing for centralized system. More centralized control over contractual arrangements. Economic stability to do so. There is no time/money to allocate toward a more ambitious program.</p>					<p>The number one opportunity reported by large-hub, medium-hub, and small-hub airports was Improved recycling programs across airlines.</p> <p>Non-hub airports identified Encouragement from stakeholders as their top opportunity.</p> <p>Control and modification of contractual arrangements was identified as an important opportunity in follow-up comments.</p>

Figure D-7. Opportunities reported by airports in survey.

medium, and small hubs was **improved recycling programs across airlines**. Airports also reported that **aviation industry association involvement** and **financial assistance or economic incentives** could help bolster recycling efforts. Figure D-7 summarizes the responses by airport size category.

Survey respondents were asked to select the key groups that are most critical to making an airline recycling program successful. Airlines most commonly selected **airline flight cabin crews** and **airline management**, as shown in Figure D-8. Airports identified **airline management**, followed by **airline flight cabin crews** and **airport management**. Figure D-9 presents airport responses by size category.

Most Important Groups Reported by Airlines	Airlines	Airlines (8 respondents)
1. Airline flight cabin crew	6 75%	
2. Airline management	6 75%	
3. Airline cabin service contractor	3 38%	
4. Airport management	2 25%	
5. Airport contractors	2 25%	
6. Airline ground crew staff	2 25%	
7. Airline flight catering contractor	1 13%	
8. Other (see below):	1 13%	
<p>Formulate a team to work together to make the program successful -- from airports, Air Transport Association, airline inflight services, communications, environmental, operations, and vendors.</p>		<p>Airlines surveyed identified inflight cabin crews and airline management as key groups for making recycling programs for deplaned materials successful.</p>

Figure D-8. Most important groups to make airline recycling successful, as reported by airlines in survey.

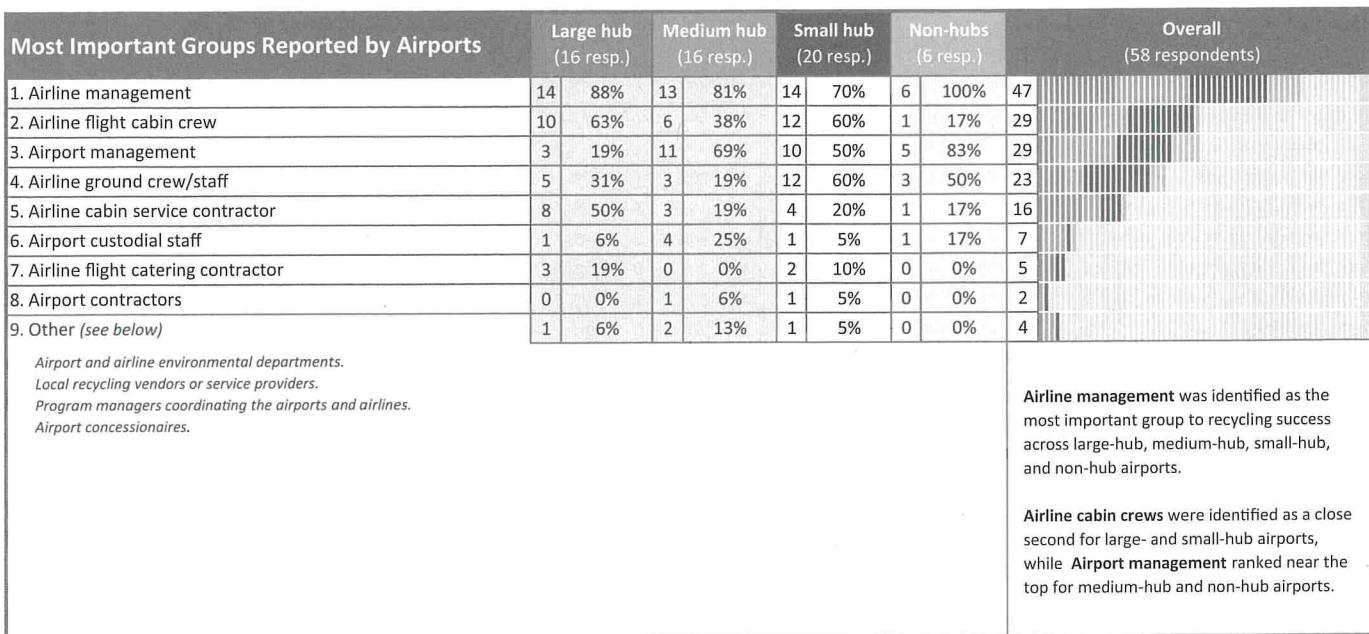


Figure D-9. Most important groups to make airline recycling successful, as reported by airports in survey.



APPENDIX E

Additional Best Practices

This section highlights innovative waste reduction and recycling best practices in addition to those presented in the main body of the guidebook. The examples listed are intended to illustrate applications or achievements related to specific practices, not to endorse specific companies or products.

- Collaborate with vendors to
 - Design products and packaging with zero waste in mind.
 - Minimize disposable packaging and products (such as using returnable plastic pallets with large rubber bands instead of wooden pallets with plastic pallet wrap). For more resources and examples, see StopWaste.org's Use Reusables program website: www.usereusables.com.
 - Take responsibility for end-of-life management of products. Such efforts may involve taking back materials after their useful life and either repairing items for reuse or recycling them into new products.
 - Create products made from your organization's recycled materials, such as recycling waste paper into in-flight magazines.
- Use online material exchanges to sell or donate surplus equipment and materials. Examples include Craigslist (www.craigslist.org), Freecycle (www.freecycle.org), eBay (www.ebay.com), and industrial materials exchanges (U.S. Environmental Protection Agency directory of state-specific exchanges: www.epa.gov/osw/conserve/tools/exchstat.htm).
- Facilitate passenger or employee contests to develop innovative ideas to reduce waste. Starbucks' Betacup Challenge is an example of a customer contest: www.thebetacup.com.
- Create a contest to reward passengers, flight attendants, and other participants who generate the least amount of waste on individual flights (airlines) or gates (airports).
- Prevent surplus food through best practices related to procurement, inventory management, and food preparation. Use related technological solutions, such as Lean Path, a company that provides comprehensive waste tracking technology packages to help foodservice operators reduce food waste, save food dollars, and operate more sustainable facilities: www.leanpath.com.
- Provide perks, such as an extra snack or bonus miles, for passengers who bring their own reusable mug or cup for use on the plane.
- Create web portals for sharing information on waste reduction and recycling with passengers, employees, airports, airlines, flight kitchens, contractors, and others across the aviation industry.
- Offer zero-waste food and beverage meal options.
- Encourage the use of mobile apps instead of printed boarding passes. Passengers could be reminded at the point of ticket purchase online, in reminder check-in emails/texts, and by check-in counter staff or at self-check-in kiosks.

- Use electronic instead of print communication wherever possible, such as marketing, internal communications, billing, instructional manuals, and administration.
- Create reuse stations for lightly used supplies and materials.
- Remove the company or individual employees from unwanted (junk) mail lists.
- Compost at flight kitchens, headquarters, or other locations, where feasible. Compost can be collected by a service provider for processing at a composting facility, or generators may consider “in-vessel” systems for on-site composting.

Abbreviations and acronyms used without definitions in TRB publications:

A4A	Airlines for America
AAAE	American Association of Airport Executives
AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ACI-NA	Airports Council International—North America
ACRP	Airport Cooperative Research Program
ADA	Americans with Disabilities Act
APTA	American Public Transportation Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATA	American Trucking Associations
CTAA	Community Transportation Association of America
CTBSSP	Commercial Truck and Bus Safety Synthesis Program
DHS	Department of Homeland Security
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
HMCRP	Hazardous Materials Cooperative Research Program
IEEE	Institute of Electrical and Electronics Engineers
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
ITE	Institute of Transportation Engineers
MAP-21	Moving Ahead for Progress in the 21st Century Act (2012)
NASA	National Aeronautics and Space Administration
NASAO	National Association of State Aviation Officials
NCFRP	National Cooperative Freight Research Program
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
NTSB	National Transportation Safety Board
PHMSA	Pipeline and Hazardous Materials Safety Administration
RITA	Research and Innovative Technology Administration
SAE	Society of Automotive Engineers
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (2005)
TCRP	Transit Cooperative Research Program
TEA-21	Transportation Equity Act for the 21st Century (1998)
TRB	Transportation Research Board
TSA	Transportation Security Administration
U.S.DOT	United States Department of Transportation

TL681 .C3 R43 2014
00001590



TRANSPORTATION RESEARCH BOARD

500 Fifth Street, NW
Washington, DC 20001

ADDRESS SERVICE REQUESTED



62944/AC100 / AUTO***3-DIGIT 722
1
MRS. ELISHA WRIGHT-KEHNER
ARKANSAS STATE HIGHWAY AND TRANSPORTATION DEPARTMENT
PO BOX 2261
LITTLE ROCK, AR 72203-2261

369 S7 P1



NATIONAL ACADEMY OF SCIENCES
1863–2013 • Celebrating 150 Years of Service to the Nation

THE NATIONAL ACADEMIES™
Advisers to the Nation on Science, Engineering, and Medicine

The nation turns to the National Academies—National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and National Research Council—for independent, objective advice on issues that affect people's lives worldwide.

www.national-academies.org

ISBN 978-0-309-28367-0

90000

9 780309 283670

Non-profit Org.
U.S. Postage
PAID
Merrifield, VA
Permit No. 2333